LEARN THE BEST WAY TO INSULATE THE ROOF

FLAT ROOFS
It is possible to reduce insulation layer thickness: this is very important for insulating existing roofs that are limited by attics, gutters, etc.

Reduction in insulation thickness and low weight of the boards (low material density: 30 kg/m³) – lower weight of the whole cladding means lower cost of bearing steel structure by up to 20%!

THERMANO boards have exceptionally high energy efficiency, which brings the following effects:

- It is possible to reduce insulation layer thickness: this is very important for insulating existing roofs that are limited by attics, gutters, etc.
- Reduction in insulation thickness and low weight of the boards (low material density: 30 kg/m³) – lower weight of the whole cladding means lower cost of bearing steel structure by up to 20%!

Example

Thermal insulation of a 5000 m² roof with mineral wool of 130 kg/m³ density and 200 mm thickness, meeting the U=0,20 W/m²·K thermal insulation requirement, weighs as much as 130 tonnes.* In contrast, if PIR foam THERMANO boards of 113 mm thickness meeting the requirements are used, the weight is only 17 tonnes!** The excessive weight of a mineral wool insulated roof becomes even more significant in winter, if the roof also has to bear the load of snow.

* for mineral wool with thermal conductivity coefficient $\lambda=0,037$ W/m·K and 200 mm thickness, the heat transfer coefficient is $U=0,19$ W/m² K
* for THERMANO board with thermal conductivity coefficient $\lambda=0,023$ W/m·K and 113 mm thickness, the heat transfer coefficient is $U=0,20$ W/m² K
**Compare thermal insulators**

**Technical requirements for flat roofs**

Technical requirements for flat roofs in buildings with interior temperatures >16°C

<table>
<thead>
<tr>
<th>For general purpose buildings, production, warehouse and storage buildings</th>
<th>Required U&lt;sub&gt;max&lt;/sub&gt;</th>
<th>U [W/m²·K]</th>
<th>R [m²·K/W]</th>
<th>Weight kg/m²</th>
<th>Thickness [mm]</th>
<th>U [W/m²·K]</th>
<th>R [m²·K/W]</th>
<th>Weight kg/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>as of 1 January 2014*</td>
<td>0,20</td>
<td>0,20</td>
<td>5,08</td>
<td>3,6</td>
<td>200</td>
<td>0,19</td>
<td>5,41</td>
<td>26,0</td>
</tr>
<tr>
<td>as of 1 January 2017*</td>
<td>0,18</td>
<td>0,16</td>
<td>6,26</td>
<td>4,2</td>
<td>220</td>
<td>0,16</td>
<td>5,95</td>
<td>28,60</td>
</tr>
<tr>
<td>as of 1 January 2021*</td>
<td>0,15</td>
<td>0,14</td>
<td>7,13</td>
<td>4,8</td>
<td>280</td>
<td>0,14</td>
<td>7,57</td>
<td>36,40</td>
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</tbody>
</table>

* Required insulation indices for the years 2014, 2017, 2021 according to the Ordinance of the Ministry of Infrastructure and Development of 5.07.2013

**Technical loads**

Taking into account the required heat transfer parameters for flat roofs, the load of thermal insulation in the case of mineral wool is eight times higher than the one of PIR THERMANO meeting the same thermal insulation requirements!

This is because PIR THERMANO not only has much better insulation properties, which influences the quantity of material needed for insulation (thicker PIR material has the same insulation properties as wool), but also differs with regard to material density (30 kg/m³ for PIR THERMANO in comparison to 130 kg/m³ for mineral wool).

Thanks to much lower weight of PIR THERMANO in comparison with competitive mineral wool products, the construction of the whole building requires less in terms of load bearing capacity and hence it is possible to considerably reduce the construction costs – even up to 20%!
Example

For a building with a flat roof (up to 3.5% inclination) located in snow load zone 3 (1.44 kN/m²), the roof structure consisting of:

- TR50.260.1038 structural trapezoidal sheet, 0.75 mm thickness – the computational load is 0.077 kN/m²
- Vapour insulation and roof cladding layers - 0.022 kN/m²
- Thermal insulation with a thickness meeting the applicable heat transfer coefficient for this type of roof (for PIR THERMANO 113 mm = 0.033 kN/m², for mineral wool 200 mm thickness = 0.36 kN/m²); load differences may be up to 15% in favour of THERMANO.

ECOLOGY

THERMANO PIR is a modern, eco-friendly and safe material with exceptional thermal insulation properties.

Multifactorial, standardised LCA (Life Cycle Assessment) analyses have shown, that PIR foams are a material with the lowest environmental costs counted from production stage through routine use to final liquidation, among building thermal insulators. They have the lowest ADP – Abiotic Depletion. Potential and the highest modification possibilities by using ecological renewable materials (plants).

They are completely free from ODP (Ozone Depletion Potential) compounds.

They are recyclable and mostly reusable. The material does not contain any elements, additives or fibres that might cause throat, eye or skin irritation.

High stress resistance - 150 kPa (15 ton/m²)

The fact that stress resistance is almost twice higher than the one of insulation fibre materials means: No risk of surface mechanical damage: it is possible to walk on the roof without the risk of damaging it, e.g. to do maintenance works or remove snow.

Low absorbability

- 2% or lower

- resistance to fingi, mould, germs, rodents

Easy assembly

- easy treatment
- excellent cooperation with various vapour and hydro membranes and other finishing materials

- low risk of the so-called assembly flaws
APPLICATION

Modern flat roof thermal insulation on trapezoidal sheet


Modern thermal insulation of a flat roof on concrete structural ceiling

THERMANO is a hard, polyisocyanurate (PIR) thermal insulation board, 100% freon free (does not contain CFC and HCFC).

PIR is manufactured as a result of liquid ingredient foaming reaction (mainly organic ingredients from polyol and isocyanate groups) with an addition of an active foaming agent. This compound is continuously fed between two linings that limit the foamed volume.

These processes lead to creation of small cell structure with over 90 % of closed cells filled with gas of very low heat conductivity. Such structure gives very good resistance parameters and exceptional thermal insulation properties of the material – a much better one in comparison with mineral wool and Styrofoam.

Thermal insulation properties are optimised by the right selection of organic ingredients, indispensable chemical additives and fully ecological foamer.

Technical parameters according to PN-EN 13165 standard
- Thermal conductivity coefficient \( \lambda = 0.023 \) [W/m·K], taking ageing into account
- Bulk density: 30 kg/m\(^2\)
- Compressive stress 150 kPa (at 10% deformation)
- Absorbability <= 2%
- Tensile strength TR70
- Water vapour resistance: \( \mu = 50-100 \)
- Euro fire class E

Dimensions
- Total width: 1200 mm
- Modular (covering) width:
  - 1185 mm (for TOP lock - overlapping),
  - 1200 mm (for BASIC lock – straight edge)
- Total length: 2400 mm
- Modular (covering) length:
  - 2385 mm (for TOP lock - overlapping),
  - 2400 mm (for BASIC lock – straight edge)
- Other dimensions:
  - 600 x 1200 mm, 1200 x 1200 mm
- boards of length up to 5000 mm may be produced at a special request
- Available board thicknesses
  - 40, 50, 60, 80, 100, 113, 120 mm
In the foam polyurethane group, hard polyisocyanurate (PIR) boards in aluminium foil cladding are relatively the most resistant to fire. The special composition of the material significantly increases ignition temperature and usual application temperature range, making these boards more resistant to fire than certain popular thermal insulation materials used in the building industry.

**THERMANO** in roof systems covered with PVC membrane or heat-weldable roofing has been tested for fire resistance by FIRES Testing Laboratory and obtained RE30/REI20 class, irrespective of whether the supporting layer is trapezoidal sheet or reinforced concrete elements.

This test result meets the requirements of “Technical conditions for buildings and their location” for the roof of buildings with even the highest “A” fire resistance class.

In the tested systems, only **THERMANO** was used as thermal insulation, without additional fire protection layers, e.g. from mineral wool.

**THERMANO** has the European fire reaction class - Euroclass E.

*In direct contact with fire, a charred layer develops on top of the board, preventing further fire access and increasing the system’s fire resistance (a barrier against further fire penetration of the material).*
Thanks to their exceptional energy efficiency, low weight and easiness of application, THERMANO bards are perfect for thermal insulation of flat roofs made of trapezoidal sheet or concrete. They conform to roof thermal insulation requirements at a relatively lower thickness in comparison to other materials.

The boards are put on a supporting substrate covered with vapour insulation layers. The substrate should be even and dry, and all debris from building works (e.g. screws, nails, metal chips and fillings) should be removed prior to mounting.

Depending on the roof shape and how complicated it is, THERMANO boards may be cut by commonly available tools, such as jigsaws, wood and metal saws, sharp knives, etc.
3. Board laying

**THERMANO** boards are put on the vapour insulation layer, e.g. PE foil or heat-weldable roofing. For trapezoid sheet substrate, lay them with the longer side perpendicular to the sheet ridges: this will facilitate mounting pins to trapezoid ridges.

Lay the boards very carefully avoiding gaps in the thermal insulation layer. Any possible glitches may be filled with low pressure polyurethane foam.

**THERMANO** boards may be placed in single or double layers. In both cases, stick to the staggering system, to avoid having the edges of boards in the same places in both layers. The boards should be placed as shown in the above diagram and picture.
4. Mounting the boards

The tool kit for mounting the boards consists of: a telescopic joint (sleeve) + an appropriate screw. The minimum number of screws to mount thermal insulation boards to the substrate are 2 pieces per 1 m² (6 pieces per 1200x2400 mm board). The joints are mounted according to the pattern. It is forbidden to mount more than one board with one joint.

<table>
<thead>
<tr>
<th>THERMANO insulation thickness [mm]</th>
<th>R45 case + PS4,8 screw [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>60 + 60</td>
</tr>
<tr>
<td>100</td>
<td>80 + 60</td>
</tr>
<tr>
<td>113</td>
<td>100 + 60</td>
</tr>
</tbody>
</table>

5. Hydro-insulation

Once mounted, THERMANO thermal insulation is covered with a waterproofing layer. Mount the roof waterproofing, in the form of PVC TPO/FPO, EPDM membranes or bituminous roofing by mechanical joints, according to the manufacturer’s instructions.
ASSEMBLY DETAILS OF THERMANO THERMAL INSULATION ON FLAT ROOFS

THERMANO boards on a flat roof, concrete substrate – single layer system

- Waterproofing
- THERMANO thermal insulation board
- Vapour insulation
- Sloping layer
- Reinforced concrete substrate

THERMANO boards on a flat roof, concrete substrate – double layer system

- Waterproofing
- THERMANO thermal insulation board
- Vapour insulation
- Sloping layer
- Reinforced concrete substrate
THERMANO boards on a flat roof, trapezoid sheet substrate – double layer system
**Roof water drainage detail**

- Waterproofing
- THERMANO thermal insulation board
- Vapour insulation
- Sloping layer
- Reinforced concrete substrate
- Sealing according to the project of roof drain manufacturer

**Roof expansion joint detail**

- Waterproofing
- THERMANO thermal insulation board
- Vapour insulation
- Sloping layer
- Reinforced concrete substrate
- Protective strap of flexible waterproofing
- Sealing weld
- Permanently flexible material
- Fastener in telescopic sleeve
- Flexible expansive filler
**Low parapet wall thermal insulation detail**

- **Waterproofing**
  - THERMANO thermal insulation board
  - Vapour insulation
  - Sloping layer
  - Reinforced concrete substrate
  - Plaster

- **Stay made of flat bar**
  - Rivet
  - Sealing tape, e.g. butyl tape
  - Gutter flashing with coating allowing the connection with waterproofing

- **Gutter hook**
  - Gutter
  - Individual flashing with minimum thickness of 0.88 mm

- **Wood battens** every 400 – 600 mm, space between battens filled with thermal insulating material

- **Sealing tape**, e.g. butyl tape

- **Gutter flashing with coating** allowing the connection with waterproofing

**Parapet wall corner section**

- **Wood screw**
  - Batten anchoring

- **Blind rivet**

**Roof water drainage detail – water drain to the gutter**

- **Waterproofing**
  - THERMANO board

- **Vapour insulation**

- **Sloping layer**

- **Reinforced concrete substrate**

- **Plaster**

- **Stay made of flat bar**

- **Rivet**

- **Sealing tape, e.g. butyl tape**

- **Gutter hook**

- **Gutter**

- **Individual flashing** with minimum thickness of 0.88 mm

- **THERMANO thermal insulation board**

- **Vapour insulation**

- **Sloping layer**

- **Reinforced concrete substrate**

- **Plaster**

- **Stay made of flat bar**
Detail of low parapet wall or adjacent wall thermal insulation

Roof skylight support detail
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We will provide you with plans of roofs resistant to Polish weather conditions, giving you advice and calculation of savings.