STYROFOAM®
extruded polystyrene foam insulation

DOW CHEMICAL COMPANY - STYROFOAM
- Dow Chemical Company
  - founded in 1897 by Herbert H. Dow
  - 2nd largest chemical company of the World
  - XPS global market leader - 50% market share
  - 11 Styrofoam manufacturing sites in Europe
- STYROFOAM
  - invented in 1941 - buoyancy billets for the U.S. Navy
  - 1940s: application for insulation purpose - cold stores
  - 1950s: inverted roofs - ROOFMATE
  - 1964: first European manufacturing site - Terneuzen (Holland)
  - 1980s: first larger projects in Central Eastern Europe
  - 1991: manufacturing site in Hungary (Balatonfüzfő)
STYROFOAM - MANUFACTURING SITES IN EUROPE

- Norrköping
- Correggio
- Dilovasi
- Bilbao
- Terneuzen
- King’s Lynn
- Schkopau
- Rheinmünster
- Balatonfüzfő
- Drusenheim
- Estarreja
- Lavzon

MARKET SHARE OF INSULANTS IN EUROPE

- FIBRES 55%
- EPS 30%
- PU 5%
- XPS 5%
- OTHERS 5%
- DOW
- BASF
**STYROFOAM - CLOSED CELL STRUCTURE**

- Consistently high insulation value
- Negligible water absorption (<0.5 Vol% / 28 days imm.)
- High compressive strength (200 - 700 kPa)
- Resistance to freeze-thaw cycles
- Dimensional stability, stiffness
- Resistance to rotting and aging
- Simple and precise installation methods

**XPS INSULATION - ADVANTAGES, PROPERTIES**
WATER ABSORPTION OF INSULATION MATERIALS

WATER ABSORPTION BY LONG-TERM IMMERSION

WATER ABSORPTION OF PLASTIC FOAMS BY LONG-TERM DIFFUSION
**WATER ABSORPTION OF INSULATION MATERIALS**

**IMPACT OF WATER ABSORPTION BY DIFFUSION TO THERMAL CONDUCTIVITY**

(W/mK)

- **Dry Conditions**
  - XPS: 0.025
  - EPS: 0.037
  - PU: 0.030

- **After Diffusion Test**
  - XPS: >0.103
  - EPS: 0.062

**WATER ABSORPTION OF INSULATION MATERIALS**

**WATER ABSORPTION AND CHANGE OF COMPRESSIVE STRENGTH BY FREEZE-THAW CYCLES**

- **Water Pick-up (Vol%)**
  - XPS: 352 kPa
  - EPS: 218 kPa

- **Number of Cycles**
  - XPS: 141 kPa
  - EPS: 141 kPa

- **XPS: 345 kPa**

**9/17/2008**
**COMPRESSIVE STRENGTH OF PLASTIC FOAMS**

<table>
<thead>
<tr>
<th>Foam Type</th>
<th>Compressive Strength</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floormate 200</td>
<td>200 kPa</td>
<td>25 kg/m³</td>
</tr>
<tr>
<td>Floormate 500</td>
<td>500 kPa</td>
<td>30 kg/m³</td>
</tr>
<tr>
<td>Roofmate SL</td>
<td>700 kPa</td>
<td>35 kg/m³</td>
</tr>
<tr>
<td>Styrofoam IB</td>
<td>250 kPa</td>
<td>40 kg/m³</td>
</tr>
<tr>
<td>Floormate 200</td>
<td>300 kPa</td>
<td>50 kg/m³</td>
</tr>
<tr>
<td>EPS/PUR 30-35 kg/m³</td>
<td>200 kPa</td>
<td></td>
</tr>
<tr>
<td>EPS 25-30 kg/m³</td>
<td>150 kPa</td>
<td></td>
</tr>
</tbody>
</table>
ENVIRONMENTAL REGULATIONS ABOUT OZONE DEPLETING SUBSTANCES

- Montreal Protocol - ban of CFCs by 1996
- EC 30/1994 and 2037/2000 EU Regulations
  - Ban of HCFCs used for manufacturing XPS: as of January 1, 2002
  - Ban of HCFCs used for manufacturing PU: as of January 1, 2003
  - Ban of HCFCs used for all foam products: as of January 1, 2004
- Implementation in Dow - STYROFOAM production:
  - by 2002 all STYROFOAM plants in the EU + Hungary have been converted into HCFC-free technology
  - plant in Turkey remains using HCFC blowing agent

CFC: Chloro-Flouro-Carbonate ("saturated freon")
HCFC: Hydro-Chloro-Flouro-Carbonate ("soft freon")
HFC: Hydro-Flouro-Carbonate (non-freon substance)

XPS FOAM BLOWING AGENT GASES - WHY CO2?

CFC/HCFC TECHNOLOGY ODP GWP
- CFC-12 ("saturated freon", for SF till 1992) 100 % 8500
- HCFC-142b/22 ("soft freon", for SF 1992-1999) 11 % 3700
- HCFC-142b/CO2 ("soft-freon", for SF 2000-2001) 6.5 % 2000

HCFC-FREE TECHNOLOGIES ODP GWP
- CO2 (STYROFOAM-A, competition) 0 1
- HFC-134a (STYROFOAM-X with low λ-value) 0 1300
- HFC-152a (Competition for high thickness) 0 300

ODP = Ozone Depletion Potential
GWP = Global Warming Potential (greenhouse-effect)
During a continuous diffusion process there is an exchange of gases. The cell gas contains less and less blowing agent and more air. While the $\lambda$-value of the air is higher than the $\lambda$-value of the blowing agent gas, the value of the thermal conductivity is increasing up to a limit value. The declared aged value is the reference value of the lambda reflected to the estimated life-term of the product (50 years).
**THERMAL CONDUCTIVITY**

Determination of aged design value by ÖNORM / DIN

- **HCFC:** \( \lambda_{90d} + 20\% \)
  - 0.027 \( \Rightarrow \) 0.032 (WLG035)
  - 0.024 \( \Rightarrow \) 0.029 (WLG030)

- **CO2:** \( \lambda_{90d} + 5\% \)
  - 0.033 \( \Rightarrow \) 0.035 (WLG035)
  - 0.036 \( \Rightarrow \) 0.038 (WLG040)

- **HFC134a:** \( \lambda_{90d} + 20\% \)
  - 0.027 \( \Rightarrow \) 0.032 (WLG035)

Declared value by EN13164 XPS Product Standard 2001

- **HCFC (slicing method+90/90%)**
  - 0.027 \( \Rightarrow \) 0.029/0.030
  - 0.024 \( \Rightarrow \) 0.027/0.028

- **CO2 (90/90%)**
  - 0.033 \( \Rightarrow \) 0.034/0.035
  - 0.036 \( \Rightarrow \) 0.036/0.038

- **HFC134a (slicing method+90/90%)**
  - 0.027 \( \Rightarrow \) 0.029/0.030

Application related design value by EN ISO 10456 norm

**XPS COMPETITION**

- **HCFC-free products:**
  - **Dow:** Styrofoam-A (CO2), Styrofoam-X (HFC134a)
  - **BASF:** Styrodur C (CO2)
  - **Poliglas:** Glascofoam N (CO2), Glascofoam III (HFC152a), Glascofoam IV (HFC134a?)
  - **Austrotherm:** Austrotherm TOP (CO2), Austrotherm XPS (HFC152a)

- **Austria, Switzerland**
  - Since January, 2000 only HCFC-free products!
STYROFOAM - INSULATION FROM CELLAR TO ROOF

ROOFMATE SL
ROOFMATE LG
ROOFMATE TG
PERIMATE DI
FLOORMATE 200
FLOORMATE 500
FLOORMATE 700
STYROFOAM IB
AGMATE TG

STYROFOAM - MAIN CONSTRUCTION APPLICATIONS
Inverted flat roofs

STANDARD BUILD-UP

- 5 cm gravel ballast (16/32 mm)
- diffusion open separation layer
- ROOFMATE SL insulation, (SINGLE LAYER!) (SINGLE LAYER!)
- waterproofing membrane
- reinforced concrete slab

TEMPERATURE OF THE WATERPROOFING MEMBRANE

Inverted roof
Conventional roof + gravel
Conventional roof

Graphs showing temperature variations.
ADVANTAGES OF INVERTED ROOFS

- protection to the waterproofing membrane against
  - UV-radiation,
  - temperature extremes,
  - mechanical effects.
  ⇒ longer life expectancy (45-50 years)
- simple build-up (building physics)
  - negligible risk of condensation
  - additional vapour barrier is not needed
- easy, weather independent installation
- simple application at renovation

REQUIREMENTS TO THE DIFFERENT STRUCTURAL LAYERS

- Load bearing structure
  - sufficient load-bearing capability
  - a minimal mass (heat storage capacity) required - reinf. concr.slab
  - light-weight structures:
    - a minimal thermal resistance required - $R \geq 0.15 \text{ m2K/W}$
    - slope (1-3%)
- Waterproofing membrane
  - rot resistant reinforcement / basis
  - XPS compatible
- Thermal insulation: extruded polystyrene foam (XPS)
  - ROOFORMATE SL, FLOORMATE 500, FLOORMATE 700
- Separation layer plastic geotextile
  - diffusion open, low water retention capability, rot resistant
  - high tensile strength
Inverted flat roofs

HEAT STORAGE CAPACITY OF ROOF STRUCTURE

5 °C

18 °C

20 °C

Inverted flat roofs

REQUIREMENTS TO THE INSULATION MATERIAL

- Compressive strength: ≥ 300 kPa
- Water absorption
  - 28 days immersion (EN12088) ≤ 0.5 Vol.%
  - 28 days diffusion (EN12089) ≤ 3.0 Vol.%
  - 300 freeze-thaw cycles (EN12091) ≤ 1.0 Vol.%
### Inverted flat roofs

#### XPS vs. “SUPER” EPS

<table>
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<tr>
<th>Property</th>
<th>ROOFMATE SL-A</th>
<th>“super” EPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density (kg/m³)</td>
<td>≥ 32</td>
<td>≥ 30</td>
</tr>
<tr>
<td>Thermal conductivity (W/mK)</td>
<td>0.034/0.036</td>
<td>0.035</td>
</tr>
<tr>
<td>Compressive strength (kPa)</td>
<td>≥ 300</td>
<td>≥ 180-200</td>
</tr>
<tr>
<td>Long-term comp. strength (kPa)</td>
<td>≥ 110</td>
<td>≥ 36-60</td>
</tr>
<tr>
<td>Water absorption (Vol%)</td>
<td>- 28 days immersion: 0.2 (≤ 0.5)</td>
<td>0.7-4</td>
</tr>
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<td></td>
<td>- 28 days diffusion test: 0.5-2 (≤ 3.0)</td>
<td>1-8</td>
</tr>
<tr>
<td></td>
<td>- 300 freeze-thaw cycles: &lt;1.0 (≤ 1.0)</td>
<td>5-15</td>
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</tbody>
</table>

#### ROOFMATE SL

<table>
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<th>Property</th>
<th>ROOFMATE SL-A</th>
<th>ROOFMATE SL-X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density, min.</td>
<td>32 kg/m³</td>
<td>30 kg/m³</td>
</tr>
<tr>
<td>Thermal conductivity - ( \lambda_d )</td>
<td>≤ 80 mm: 0.035</td>
<td>≤ 120 mm: 0.029</td>
</tr>
<tr>
<td></td>
<td>100-120 mm: 0.036</td>
<td>&gt;120 mm: 0.038</td>
</tr>
<tr>
<td>Compressive strength</td>
<td>0.30 N/mm²</td>
<td>0.30 N/mm²</td>
</tr>
<tr>
<td>Diffusion resistance fact.</td>
<td>≥ 200-80</td>
<td>200-80</td>
</tr>
<tr>
<td>Water pick-up by imm.</td>
<td>&lt; 0.5</td>
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</tr>
<tr>
<td>Combustibility (by DIN 4102)</td>
<td>B1</td>
<td>B1</td>
</tr>
<tr>
<td>Dimensions</td>
<td>mm 1250 x 600</td>
<td>mm 1250 x 600</td>
</tr>
</tbody>
</table>

Edge profile: shiplap
Surface: skin

---

*Note: The images show diagrams of ROOFMATE SL and ROOFMATE SL-A foam products.*
Inverted flat roofs

STANDARD BUILD-UP WITH GRAVEL REDUCTION

- 5 cm gravel ballast (16/32 mm)
- Typar diff. open plastic geotextile
- ROOFMATE SL insulation (SINGLE LAYER, staggered joints)
- waterproofing membrane
- reinforced concrete slab

MAX. WATER ABSORPTION OF XPS
(incorrect build-up, 2-layers, etc.)

Time (years)

Water pick-up (Vol %)

4 cm
6 cm
8 cm
10 cm
12 cm
14 cm
16 cm
18 cm
20 cm
22 cm
24 cm
26 cm
28 cm
30 cm
Inverted flat roofs

INVERTED ROOFS WITH LIGHT-WEIGHT BALLAST

Inverted flat roofs - terrace roofs

TERRACE ROOFS

- Concrete paving slabs on crushed gravel bed
- Concrete paving slabs on distance holders
- Adhered tiles on reinforced concrete slab
Inverted flat roofs - terrace roofs

PAVING SLABS ON CRUSHED GRAVEL BED
- Concrete paving slabs
- 3 cm 4/8 mm crushed gravel bed on diffusion open separation layer (Typar)
- ROOFMATE SL insulation
- Waterproofing membrane
- Reinforced concrete slab

PAVING SLABS ON DISTANCE HOLDERS
- Concrete paving slabs on spacers
- Diffusion open separation layer (Typar)
- ROOFMATE SL insulation
- Waterproofing membrane
- Reinforced concrete slab
Inverted flat roofs - terrace roofs

ADHERED TILES ON CONCRETE SLAB

- Tiles adhered to reinf.concrete slab + diffusion open separation layer
- Crushed gravel bed on diffusion open separation layer
- ROOFMATE SL insulation
- Waterproofing membrane
- Reinforced concrete slab
Vehicle accessed inverted flat roofs

**PARKING DECKS WITH REINFORCED CONCRETE SLAB**

1. Load distribution slab - min. 10 cm
2. Diffusion open separation layer
3. 3 cm 4/8 mm crushed stone diff. layer
4. Diffusion open separation layer (Typar)
5. FLOORMATE 500 / (FLOORMATE 700)
6. Waterproofing membrane
7. Reinf. concrete slab (1.5-2.5% slope)
Vehicle accessed roofs with concrete slab

Vehicle accessed inverted flat roofs

PARKING DECKS WITH INTERLOCKING PAVING BLOCKS

1 - Concrete paving blocks - min. 10 cm
2 - 5 cm 2/8 mm crushed gravel bed
3 - Diffusion open separation layer (Typar)
4 - FLOORMATE 700 / (FLOORMATE 500)
5 - Waterproofing membrane
6 - Reinf. concrete slab (1.5-2.5% slope)
Parking decks with interlocking paving blocks
Parking decks with interlocking paving blocks

Important:
- shape / profile of elements: interlocking!
- framing of the paved areas

LAYING PRINCIPLES - THICKNESS OF THE ELEMENTS
Parking decks with interlocking paving blocks

LAYING PRINCIPLES - FRAMING OF WATER-OUTLETS, ETC.

Inverted flat roofs - parking decks

EXPECTED AVERAGE MOISTURE CONTENT OF THE INSULATION AFTER 25 YEARS

- Parking deck with interlocking paving blocks
  - 60 - 120 mm insulation: 5 - 7 Vol% 
- Parking deck with reinforced concrete slab
  - 50 - 120 mm insulation: 2 - 6 Vol%
Inverted flat roofs - green roofs

Extensive green-roof with mineral substrate, no separate drainage
- 6-10 cm mineral substrate
- separation layer (Typar)
- ROOFMATE SL insulation
- waterproofing membrane
- load bearing slab (2% slope)

Extensive green-roof with drainage
- vegetation / soil / substarte
- separation layer (Typar)
- drainage (gravel, EPS-board, plastic plate...)
- separation layer (Typar)
- ROOFMATE SL insulation
- waterproofing membrane
- load bearing slab (2% slope)

Intensive green-roof with drainage
- separation layer (Typar)
- ROOFMATE SL insulation
- waterproofing membrane
- load bearing slab (2% slope)
Extensive green-roofs
   – light-weight build-up
   – minimal maintenance need
   – no need for water-supply

Intensive roof gardens
   – full value green area
   – heavy-weight build-up
   – continuous maintenance, water-supply

Inverted flat roofs - green roofs

Extensive green-roofs
Extensive green-roofs

Extensive and intensive green-roofs
Intensive green-roofs/terraces

Extensive green-roofs/terraces

- Roof with mineral substrate:
  - Insulation 60-120 mm: 3-4 Vol% 
  - Insulation >120 mm: 2-3 Vol%
- Roof with drainage:
  - Insulation 60-120 mm: 2-6 Vol% 
  - Insulation >120 mm: ~2 Vol%

Inverted flat roofs - green roofs

**EXPECTED AVERAGE MOISTURE CONTENT OF THE INSULATION AFTER 25 YEARS**

- Extensive green-roof with mineral substrate:
  - Insulation 60-120 mm: 3-4 Vol% 
  - Insulation >120 mm: 2-3 Vol%
- Extensive green-roof with drainage:
  - Insulation 60-120 mm: 2-6 Vol% 
  - Insulation >120 mm: ~2 Vol%
- Intensive roof garden with drainage:
  - Insulation 60-120 mm: ~6 Vol% 
  - Insulation >120 mm: 3-5 Vol%
Inverted flat roofs

**DUO-ROOF / PLUS-ROOF**

- **ROOFMATE LG insulation**
- **waterproofing membrane**
- **reinforced concrete slab**

**PLUS-ROOF WITH LIGHT-WEIGHT BALLAST**

- **ROOFMATE LG insulation**
- **waterproofing membrane**
- **reinforced concrete slab**
ROOFMATE TG
AGMATE TG
INSULATION OF PITCHED ROOFS

Insulation of pitched roofs

ROOFMATE TG-A / AGMATE TG-A

<table>
<thead>
<tr>
<th>Property</th>
<th>TG-A</th>
<th>TG-A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density, min.</td>
<td>kg/m³</td>
<td>32</td>
</tr>
<tr>
<td>Thermal conductivity - $\lambda_d$</td>
<td>W/mK</td>
<td>0,034/0,036</td>
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<td>Compressive strength</td>
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<td>Vapour diffusion resist.</td>
<td>$\mu$</td>
<td>200-80</td>
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<td>Water pick-up by imm.</td>
<td>Vol%</td>
<td>&lt; 0,5</td>
</tr>
<tr>
<td>Combustibility (by DIN 4102)</td>
<td></td>
<td>B1</td>
</tr>
<tr>
<td>Dimensions</td>
<td>mm</td>
<td>2500/2400 x 600</td>
</tr>
</tbody>
</table>

Edge profile: Tongue and Groove
Surface: smooth skin
**Insulation of pitched roofs**

**TRADITIONAL BUILD-UP**

Mineral fibre insulation between the rafters:
- single or double ventilation
- thermal bridge at rafters ⇒ additional insulation

**BUILD-UP WITH ROOFMATE TG / AGMATE TG INSULATION**

High strength XPS insulation boards above rafters:
- continuous insulation layer
- no thermal bridges
- rigid basis for the covering
Insulation of pitched roofs

ROOFMATE TG / AGMATE TG
AS ADDITIONAL INSULATION

New construction:
- ROOFMATE TG: during roof installation
- insulation between rafters: at finishing works
- vapour barrier is needed!

Roof refurbishment:
- additional insulation without removing the internal finishing

New construction:
- diffusion open underlayer membrane: TYVEK®
- insulation between rafters fills the full void

Roof refurbishment:
- vapour barrier is needed!
Insulation of pitched roofs

ROOFMATE TG / AGMATE TG
FOR INSULATING CONCRETE PITCHED ROOFS

Single layer insulation:
- ROOFMATE / AGMATE ≤ 120 mm
- bituminous membrane on the concrete deck or diffusion-open TYVEK® sheet above the insulation

Two-layer insulation:
- in case of high overall thickness
- simple fixing

AGMATE TG - INSULATION OF AGRICULTURAL BUILDINGS

INSULATING SUSPENDED CEILING WITH NO ADDITIONAL SURFACE FINISHING. RESISTANT TO HIGH PRESSURE CLEANING AND DESINFECTION.
PERIMATE, ROOFMATE

INSULATION, PROTECTION AND DRAINAGE FOR CELLAR WALLS

ROOFMATE SL
PERIMATE DI

Insulation of cellar walls

HEATLOSS TOWARDS THE SOIL
**Insulation of cellar walls**

**UNINSULATED HEATED CELLAR**

- **10 °C**
- **20 °C**

**SCHEMATIC VIEW OF ISOTHERMS**

(ref: Zum Mass der Waermedaemmung im Erdbereich)

**Insulation of cellar walls**

**COMFORT**

- **TEMPERATURE OF RADIATING SURFACE (°C)**
- **INTERNAL AIR TEMPERATURE (°C)**

\[ \Delta t(\text{surface - air}) \leq 2 \text{ °C} \]

- STILL ACCEPTABLE
- RISK OF CONDENSATION
- INSUFFICIENT VENTILATION
- MINIMAL RATE OF HEATING
Insulation of cellar walls

INSULATION ... WHERE?

INSIDE
- CONDENSATION RISK
- REDUCED FLOOR AREA
- INTERNAL FINISHING IS NEEDED

OUTSIDE
- UTILIZED HEAT STORAGE CAPACITY OF THE WALL
- NO CONDENSATION RISK
- INSULATION EXPOSED TO SEVERE LOADS
  - PERMANENT MOISTURE
  - FREEZE-THAW CYCLES
  - LONG-TERM LOADS (SOIL PRESSURE)
- MECHANICAL EFFECTS

ROOFMATE SL - INSULATION AND MECHANICAL PROTECTION
**INSULATION OF CELLAR WALLS**

**REQUIREMENTS TO THE INSULATION MATERIAL**

- Compressive strength: ≥ 300 kPa
- Water absorption
  - 28 days immersion (EN12088) ≤ 0.5 Vol.%
  - 28 days diffusion (EN12089) ≤ 3.0 Vol.%
  - 300 freeze-thaw cycles (EN12091) ≤ 1.0 Vol.%

**XPS vs. “SUPER” EPS**

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### Insulation of cellar walls

#### ROOFMATE SL-A

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<td>Combustibility (by DIN 4102)</td>
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<tr>
<td>Dimensions</td>
<td>mm</td>
<td>1250 x 600</td>
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</table>

Edge profile: ShipLap
Surface: smooth skin

#### ROOFMATE SL - APPLICATION

At normal moisture conditions
In static ground-water
Insulation of cellar walls

ROIOMATE SL - APPLICATION

FIXING OF ROIOMATE SL BOARDS:
SOLVENT FREE COLD BITUMINOUS ADHESIVE
- at normal conditions: 6 spots
- in ground-water:
  - if vertical drainage exists: bonding by spots
  - static ground-water: full surface bonding

Insulation of cellar walls
### PERIMATE DI-A

<table>
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</tr>
<tr>
<td>Combustibility (by DIN 4102)</td>
<td>B2</td>
</tr>
<tr>
<td>Dimensions mm</td>
<td>1250 x 600</td>
</tr>
</tbody>
</table>

- Edge profile: shiplap
- Surface: smooth skin + grooves and geotextile

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### Insulation and drainage of cellar walls

**PERIMATE DI** - **INSULATION, PROTECTION AND DRAINAGE**

- **Insulation and drainage of cellar walls**
- **Edge profile:** shiplap
- **Surface:** smooth skin + grooves and geotextile
Insulation and drainage of cellar walls

PERIMATE DI - INSULATION, PROTECTION AND DRAINAGE

FLOORMATE, ROOFMATE

INSULATION OF FLOORS

ROOFMATE SL
FLOORMATE 200
FLOORMATE 500
FLOORMATE 700
### FLOORMATE / ROOFMATE SL

<table>
<thead>
<tr>
<th></th>
<th>FM200-A</th>
<th>FM500-A</th>
<th>FM700-A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density, min. kg/m³</td>
<td>32</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>Thermal conductivity W/mK</td>
<td>0,034</td>
<td>0,035/0,037</td>
<td>0,036/0,038</td>
</tr>
<tr>
<td>Compressive strength N/mm²</td>
<td>0,20</td>
<td>0,50</td>
<td>0,65</td>
</tr>
<tr>
<td>Diffusion resistance μ</td>
<td>200-80</td>
<td>220-150</td>
<td>220-150</td>
</tr>
<tr>
<td>Water absorp. by immersion Vol%</td>
<td>&lt; 0,5</td>
<td>&lt; 0,5</td>
<td>&lt; 0,5</td>
</tr>
<tr>
<td>Combustibility (by DIN 4102)</td>
<td>B1</td>
<td>B1</td>
<td>B1</td>
</tr>
<tr>
<td>Dimensions mm</td>
<td>1200x600</td>
<td>1250x600</td>
<td>1250x600</td>
</tr>
</tbody>
</table>

Edge profile: butt edge (FM200-A) / shiplap  
Surface: smooth skin

### INSULATION OF GROUND BEARING FLOORS

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BELOW THE SLAB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABOVE THE SLAB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESIDENTIAL FLOORS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Floor insulation

INSULATION OF GROUND BEARING FLOORS

BELOW THE SLAB  ABOVE THE SLAB

Floor insulation

INSULATION OF INDUSTRIAL FLOORS
**Floor insulation**

**INSULATION OF FOUNDATION SLAB**

**INSULATION OF COLD STORES, ICE-RINKS**
Floor insulation

FLOOR HEATING

INSULATION OF THERMAL BRIDGES AND FACADE WALLS

STYROFOAM IB
ROOFMATE
EXTERNAL WALL INSULATION

PRODUCTS:
- expanded PS
- rockwool
- woodwool
- EPS
- extruded PS

CRITICAL POINTS:
- quality of installation
- details
- construction schedule
- selection of the suitable system

STYROFOAM IB

INSULATION OF THERMAL BRIDGES AND FACADE WALLS
**STYROFOAM IB-A**

<table>
<thead>
<tr>
<th>Property</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density, min.</td>
<td>kg/m³</td>
<td>32</td>
</tr>
<tr>
<td>Thermal conductivity - ( \lambda )</td>
<td>W/mK</td>
<td>0.035/0.037</td>
</tr>
<tr>
<td>Compressive strength</td>
<td>N/mm²</td>
<td>0.25</td>
</tr>
<tr>
<td>Diffusion resistance fact.</td>
<td>µ</td>
<td>150-100</td>
</tr>
<tr>
<td>Water absorption by imm.</td>
<td>Vol%</td>
<td>&lt; 1.5</td>
</tr>
<tr>
<td>Combustibility (by DIN 4102)</td>
<td></td>
<td>B1</td>
</tr>
<tr>
<td>Dimensions</td>
<td>mm</td>
<td>1250 x 600</td>
</tr>
</tbody>
</table>

Edge profile: butt edge  
Surface: planed (rough)

**STYROFOAM IB**

**FOR STRUCTURES FREE OF THERMAL BRIDGES**
For Structures Free of Thermal Bridges

**APPLICATION:**
In-situ (Lost Form) or installed after completing the concrete structures, fixed by adhesion and mechanical fastening.

**Temperature Differences:**
- 14.0°C
- 17.2°C
- 18.0°C
- 10.1°C (condensation)
- 5.5°C (mould growth)
- 15.3°C (condensation)
- 7.8°C (mould growth)
- 16.5°C
- 13.0°C
Insulation of thermal bridges and facade walls

**STYROFOAM IB**

**SOCKLE INSULATION**

- Insulation of thermal bridges and facade walls
- Application: lost form or adhesion + mechanical fixing
- Coating systems:
  - Thin coating system with glass fabric reinforcement
  - Traditional type of thick cement based plaster with using spot welded, galvanized reinforcement mesh
Insulation of thermal bridges and facade walls

**STYROFOAM IB**

**INSULATION OF FACADE WALLS WITH RENDERING**

- Insulation of thermal bridges and facade walls

**INSULATION OF MULTI-LAYER WALLS**

- **PRODUCTS:**
  - expanded PS
  - fibres
  - extruded PS
  - foam glass

- **CRITICAL POINTS:**
  - air circulation
  - details
  - thermal bridges
  - wall ties
  - quality of installation
Insulation of thermal bridges and facade walls

ROOFMATE SL / ROOFMATE TG
INSULATION FOR MULTI-LAYER WALL STRUCTURES

Internal wall insulation

°C
50 40 30 20 10 0 -10
INTERNAL WALL INSULATION

PRODUCTS:
- extruded PS
- expanded PS
- battens + fibres + PE-foil

CRITICAL POINTS:
- condensation risk
- thermal bridges
- details
- heat storage capacity ignored
- increased thermal shocks
- accuracy of installation

STyrofoam IB
INTERNAL WALL INSULATION
### SPECIFICATION OF XPS VS. COMPETITION

<table>
<thead>
<tr>
<th>Application</th>
<th>Chance to be specified/sold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inverted roof</td>
<td><strong>HIGH, few alternatives</strong></td>
</tr>
<tr>
<td>Conventional flat roof</td>
<td>low, alternatives available (EPS)</td>
</tr>
<tr>
<td>Pitched roof</td>
<td>low, alternatives available (MF)</td>
</tr>
<tr>
<td>Perimeter</td>
<td><strong>HIGH, few alternatives</strong></td>
</tr>
<tr>
<td>Floors (heavy loaded)</td>
<td><strong>HIGH, few alternatives</strong></td>
</tr>
<tr>
<td>External walls</td>
<td>low, alternatives available (EPS)</td>
</tr>
<tr>
<td>Cavity walls</td>
<td>low, alternatives available (EPS, MF)</td>
</tr>
<tr>
<td>Soil / roads</td>
<td>economic situation</td>
</tr>
</tbody>
</table>

In applications where XPS has a strong comp. adv. (i.e. compr. strength, water resistance, stability) project losses are minimal.