BREEAM COMPLIANCE PRODUCT CARD

**Technical insulation**

<table>
<thead>
<tr>
<th>BREEAM Category</th>
<th>Issue</th>
<th>BREEAM Requirements</th>
<th>Credits</th>
<th>Product compliance</th>
</tr>
</thead>
</table>
| Life cycle cost and service life planning | Man 05  | A life cycle cost and service life planning analysis of the building components should be carried out in order to obtain their full information through all the life cycle. | 3**    | NH/Armaflex life cycle information may be a part of the building analysis. The following data may be useful:  
- life cycle durability: as the service life of the equipment or the whole building (> 50 years),  
- restrictions: insulation thicknesses are available for all common pipe diameters up to an outer diameter of 114 mm for tubes; temperature range: -50°C to +110°C,  
- recycling: non-recyclable,  
- costs: during installation and utilization (no costs while in use),  
- comparison to natural rubber: better temperature resistance - less heat/cold losses and extremely constant quality.  
More information may be found in Environmental Product Declaration. |

| Life cycle impacts | Mat 01  | An environmental impact of construction materials over the building life cycle should be specified by using an appropriate life cycle assessment (LCA) tool. | 7**    | Data useful for life cycle assessment (LCA) may be found in Environmental Product Declaration. |

| Insulation         | Mat 04  | Construction materials should be responsibly sourced. A responsibly sourced confirmation of „supply chain process” and „key process” should be provided. | 2      | NH/Armaflex is responsibly sourced which may be confirmed with ISO14001 certificates for:  
- supply chain process (polymer)  
- key process (insulation production). |

| Thermal comfort    | Hea 03  | A thermal comfort analysis should be carried out to assess if the indoor environment maintains comfortable conditions for building users in terms of appropriate thermal comfort level according to ISO 7730:2005. | 2**    | NH/Armaflex is a part of building’s systems. Adjusting proper design parameters will enable to improve energy efficiency and its supply to the system appliances. For energy efficiency the main parameter of NH/Armaflex is thermal conductivity λ<sub>v</sub> < 0.045 W/mK. |

| Reduction of energy use and carbon emissions | Ene 01 | An energy performance should be carried out to assess building energy consumption during operation in comparison with the notional building (parameters defined by national standards). | 15**   |  |

| Energy efficient cold storage | Ene 05 | Greenhouse gas emissions from cold storage systems should be reduced by improving their energy efficiency. | 3**    |  |

For detailed information please refer to the documents provided by manufacturer:

1. NH/Armaflex product card  
2. Environmental Product Declaration: EPD-ARM-201510106-BB1-DE  
3. ISO 14001 certificates are available for the factories in Muenster (Germany), Sroda Słaska (Poland), Bagur (Spain) as well as for main polymers production.

**BREEAM International New Construction 2013**

BREEAM is a multi-criteria scheme to assess and certify buildings. Established in UK, it emphasises sustainable development by promoting green, healthy and eco-friendly buildings. Features of the buildings which may be assessed are: materials, quality of indoor environments and energy efficiency etc. Nowadays it has become a standard in real estates markets.

NH/Armaflex is a Halogen free, flexible closed-cell insulation material for building equipment and industrial installations.

NH/Armaflex is a part of systems Adjusting proper design parameters will enable to improve energy efficiency and its supply to the system appliances. For energy efficiency the main parameter of NH/Armaflex is thermal conductivity λ<sub>v</sub> < 0.045 W/mK.
BREEAM Compliance Product Card

NH/Armaflex

NH/Armaflex is a halogen free, flexible closed-cell insulation material for building equipment and industrial installations.

BREEAM International New Construction 2016

BREEAM is a multi-criteria scheme to assess and certify buildings. Established in UK, it emphasises sustainable development by promoting green, healthy and eco-friendly buildings. Features of the buildings which may be assessed are: materials, quality of indoor environments and energy efficiency etc. Nowadays it has become a standard in real estates markets.

BREEAM Compliance product card for NH/Armaflex was prepared to assist designers, architects, engineers, consultants and developers to provide clear information and to facilitate choosing proper product. Appropriate BREEAM categories related to NH/Armaflex features were chosen and checked. NH/Armaflex compliance and contribution to BREEAM categories are presented below.

<table>
<thead>
<tr>
<th>BREEAM Category</th>
<th>Issue</th>
<th>BREEAM Requirements</th>
<th>Credits</th>
<th>Product compliance</th>
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</thead>
</table>
| Life cycle cost and service life planning | Man 02  | A life cycle cost and service life planning analysis of the building components and elements should be carried out in order to obtain their full information through all the life cycle. | 3++. NH/Armaflex life cycle information may be a part of the building analysis. The following data may be useful: - life cycle durability as the service life of the equipment or the whole building (>50 years), - restrictions: insulation thicknesses are available for all common pipe diameters up to an outer diameter of 114 mm for tubes; temperature range: -50°C to +110°C, - recycling: non-recyclable, - costs: during installation and utilization (no costs while in use), - comparison to natural rubber: better temperature resistance - less green/hot/cold losses and extremely constant quality. More information may be found in Environmental Product Declaration². | |}
| Indoor air quality: Minimising sources of air pollution | Hea 02  | At least four of five finishing materials should meet appropriate volatile organic compounds (VOC) emission levels and confirm compliance with testing standards ISO 10580, ISO 16000-9, CEN/TS 16516 or CDPH Standard Method v1.1. VOC emission limits for insulation were listed in Tables 17 and 18 of BREEAM International NC 2016 Manual. | 2+. Sampling, testing and evaluation were performed according to ISO 16000-9. Insulation meets exemplary level emission limits³: - Formaldehyde < 0,01 mg/m³ - Total volatile organic compounds < 0,3 mg/m³ - Total semi-volatile organic compounds < 0,1 mg/m³ - Category 1A and 1B carcinogens < 0,001 mg/m³ | |}
| Life cycle impacts               | Mat 01  | At least five products out of ten material categories, including insulation products, should have Environmental Products Declarations (EPDs). In one material category maximum two products’ EPDs may be counted. The EPD must be compliant with ISO 14025, ISO 21930 or EN 15804. | 5++. Data useful for life cycle assessment (LCA) may be found in EPD². Life cycle assessment in EPD has been carried out in GaBi Software (LCA tool), which is based on ISO 14025 standard and addresses the whole life cycle of product, including disposal. | |}
| Responsible sourcing of construction | Mat 03  | Construction materials should be responsibly sourced. A responsibility sourced confirmation of “supply chain process”, and “key process” should be provided. | 4+. Using NH/Armaflex with other products having EPD will help to score a credit. NH/Armaflex EPD is compliant with ISO 14025 and ISO 15804. | |}
| Material efficiency              | Mat 06  | In order to minimise materials’ environmental impact more efficient materials should be used during building design, procurement, construction, maintenance and end of life. | 1++. NH/Armaflex is responsibly sourced which may be confirmed with ISO14001® certificates for: - supply chain process (polymer) - key process (insulation production). | |}
| Thermal comfort                  | Hea 04  | A thermal comfort analysis should be carried out to assess if the indoor environment maintains comfortable conditions for building users in terms of appropriate thermal comfort level according to ISO 7730:2005. | 3++. NH/Armaflex is a part of building’s systems. Adjusting proper design parameters will enable to improve energy efficiency and its supply to the system appliances. For energy efficiency the main parameter of NH/Armaflex is thermal conductivity λ<sub>̅</sub> ≤ 0,040 W/mK². | |}
| Reduction of energy use and carbon emissions | Ene 01  | An energy performance should be carried out to assess building energy consumption during operation in comparison with the following requirements: national building (parameters defined by national standards) and BREEAM best practice building (BREEAM defined parameters). | 15++. | |}
| Energy efficient cold storage    | Ene 05  | Greenhouse gas emissions from cold storage systems should be reduced by improving their energy efficiency. | 3++. | |}

For detailed information please refer to the documents provided by manufacturer:
1. NH/Armaflex product card
2. Environmental Product Declaration: EPC-ARM-2010/EU-061-DE
4. ISO 14001 certificates are available for the factories in ŚŚ Ś Ś, as well as for main polymers production.

* NH/Armaflex has a direct impact on the following categories. While using NH/Armaflex with another appropriate products - credits stated above may be awarded. Maximum number of credits influenced by the product for each category was stated above.

** NH/Armaflex has an indirect impact on the following categories. Using NH/Armaflex with another appropriate products may contribute to achieve credits. Maximum number of credits influenced by the product for each category was stated above.
NH/Armaflex is a Halogen free, flexible closed-cell insulation material for building equipment and industrial installations.

## LEED Compliance Product Card

**Technical insulation**

<table>
<thead>
<tr>
<th>LEED Issue</th>
<th>Credit</th>
<th>LEED Requirements</th>
<th>Points</th>
<th>Product compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>EA</td>
<td>Prerequisite 2</td>
<td>Minimum Energy Performance</td>
<td></td>
<td>Building's energy performance calculated using computer simulation model should demonstrate a 10% improvement for new buildings, or a 5% for major renovations in comparison to the baseline as a compulsory achievement by using energy efficient measures.</td>
</tr>
<tr>
<td>EA</td>
<td>Credit 1</td>
<td>Optimize Energy Performance</td>
<td></td>
<td>Building's energy performance calculated using computer simulation model should demonstrate an improvement in comparison to the baseline. Number of points awarded depends on percentage improvement and building type.</td>
</tr>
<tr>
<td>IEQ</td>
<td>Credit 3.2</td>
<td>Construction Indoor Air Quality Management Plan – before occupancy</td>
<td>1+</td>
<td>NH/Armaflex may contribute reducing air contamination. Sampling, testing and evaluation of the product determine low levels of formaldehyde and VOC.</td>
</tr>
<tr>
<td>IEQ</td>
<td>Credit 7.1</td>
<td>Thermal Comfort</td>
<td>1+</td>
<td>NH/Armaflex has an indirect impact on achieving acceptable range of operative temperature and humidity by providing protection for pipes or air ducts. Therefore it prevents condensation of the humidified air. Water vapour diffusion resistance of the product is $\mu &gt; 2000^3$.</td>
</tr>
<tr>
<td>IEQ</td>
<td>Credit 7.2</td>
<td>Thermal Comfort – Verification</td>
<td>1+</td>
<td>A measurements of relevant environmental variables in potential problem areas indicated by building's occupants should be conducted. Measurements should be carried out in accordance with ASHRAE standard 55-2004.</td>
</tr>
</tbody>
</table>

For detailed information please refer to the documents provided by manufacturer:

1. NH/Armaflex product card
2. Eurofins Product Testing A/S Attestation and Test report No. 392-2013-GSH-CEFEP_01

*NH/Armaflex has an indirect impact on the following categories. Using NH/Armaflex with another appropriate products may contribute to achieve credits. Maximum number of credits influenced by the product for each category was stated above.*
LEED COMPLIANCE PRODUCT CARD

Technical insulation

NH/Armaflex

NH/Armaflex is a Halogen free, flexible closed-cell insulation material for building equipment and industrial installations².

LEED is a multi-criteria scheme to assess and certify buildings. Established in USA, it emphasises sustainable development by promoting green, healthy and eco-friendly buildings. Features of the buildings which may be assessed are: materials, quality of indoor environments and energy efficiency etc. Nowadays it has become a standard in real estates markets.

LEED compliance product card for NH/Armaflex was prepared to assist designers, architects, engineers, consultants and developers to provide clear information and to facilitate choosing proper product. Appropriate LEED categories related to NH/Armaflex features were chosen and checked. NH/Armaflex compliance and contribution to LEED categories are presented below.

<table>
<thead>
<tr>
<th>LEED issue</th>
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<th>Points</th>
<th>Product compliant</th>
<th>Product contributes to a better rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>EA Prerequisite - Minimum Energy Performance</td>
<td>Option 1. Whole-building energy simulation</td>
<td>An energy calculation should be carried out based on a simulation model in accordance to the ANSI/ASHRAE/IESNA Standard 90.1-2010, Appendix G with errata. An improvement of 5% (new construction projects), 3% (major renovations projects), 2% (core and shell projects) over a baseline should be demonstrated.</td>
<td>10</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>EA Optimize Energy Performance</td>
<td>Option 1. Whole-building energy simulation</td>
<td>Building’s energy performance calculated using computer simulation model should demonstrate an improvement in comparison to the baseline. Number of points awarded depends on percentage improvement.</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>EQ Thermal Comfort</td>
<td>Thermal Comfort Design Option 2 and ISO and CEN Standards</td>
<td>A thermal comfort analysis should be carried out in accordance to the standards: ISO 7730:2005 and EN 15251:2007.</td>
<td>1••</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MR Building Product Disclosure and Optimization - Environmental Product Declarations</td>
<td>Option 1. Environmental Product Declarations (EPD)</td>
<td>At least 20 materials sourced from 5 different manufacturers should have product specific Type III EPD. EPD should conform standards: ISO 14025, ISO 14040, ISO 14044 and EN 15804, at least cradle to gate scope and include an external verification.</td>
<td>1••</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>EQ Low-Emitting Materials</td>
<td>Option 1. Product category calculations</td>
<td>Up to 7 product categories of finishing materials should be compliant with relevant volatile organic compounds (VOC) emission levels and testing standards: - CDPH Standard Method (2010) or - German AgBB Testing and Evaluation Scheme (2010) or - ISO 16000-3/6/11:2010 in conjunction with AgBB or French legislation on VOC emission class labeling or the DIBt testing method (2010).</td>
<td>2••</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>EQ Thermal Comfort</td>
<td>Thermal Comfort Design Option 1. ASHRAE Standard 55-2010</td>
<td>An appropriate level of thermal comfort within the building should be provided by designing HVAC systems in accordance with ASHRAE 55-2010 Thermal Environmental Conditions for Human Occupancy with errata or a local equivalent.</td>
<td>1••</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

For detailed information please refer to the documents provided by manufacturer:

¹ NH/Armaflex product card
² Environmental/Product Declaration: EPD-ARM-20150108-BBA-0E
³ Eurofins Product Testing ASI Attestation and Test report No. 392-2013-DSH-CEFRP_01
⁴ NH/Armaflex has no indirect impact on the following categories. Using NH/Armaflex with another appropriate products may contribute to achieve credit. Maximum number of credits influenced by the product for each category was stated above.