

TECHNICAL MEMO



A collection of basic technical information.



advanced elastomeric thermal and acoustic insulation materials

T E C H N I C A L M E M O

B, s_2, d_0
 B_L, s_2, d_0

$\lambda \mu$ C E



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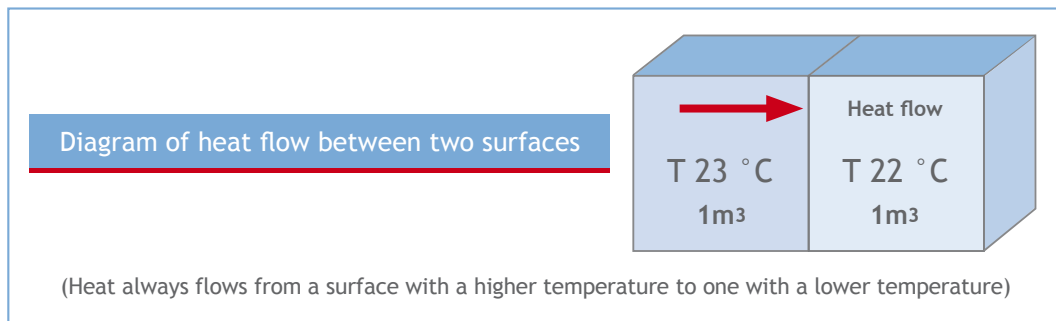
Insulation materials.
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advanced elastomeric thermal and acoustic insulation materials

Thermal conductivity λ and insulation materials

- Defined by the symbol λ (lambda), thermal conductivity is technically the quantity of heat passing through the contacting surfaces of two materials, both of which have a volume of 1 m^3 and a difference in temperature of $1 \text{ }^\circ\text{C}$.
It measures the ability of a substance to conduct heat. Given two surfaces on either side of the material with a temperature difference between them, the thermal conductivity is the heat energy transferred per unit time and per unit surface area, divided by the temperature difference, and is measured in watts per degree Kelvin.



Thermal conductivity is measured in $\text{W/m}\cdot\text{K}$ and only materials with a thermal conductivity value (λ) lower than $0,100 \text{ W/m}\cdot\text{K}$ are considered as having insulating properties.

The insulating property of a material is determined by its thermal conductivity value (λ); those with low values are considered as being more effective.

Determining factors that affect the thermal conductivity value (λ) are:

- The chemical composition of materials.
- Density (which leads to a higher thermal conductivity value (λ) and therefore an inferior insulating property).
- The characteristics of a material's cell structure.

The ability of the material to simulate and stabilize the quantity of air in its structure will ensure a lower λ value.

Black closed-cell flexible elastomeric foam Insulation material (FEF), due to its characteristics (low density, compact cell structure and a high amount of closed cells) ensures low thermal conductivity values and conforms to the recent European Standard EN 14304:2009 +A1:2013 standards which stipulate that products should not have a value higher than $0,050 \text{ W/m}\cdot\text{K}$ (at a mean working temperature of $10 \text{ }^\circ\text{C}$).

The following table shows the thermal conductivity values of the EUROBATEX elastomeric insulation material at different mean temperatures as specified on the certificates issued by specialized laboratories.

| MEAN TEMPERATURE OF TEST ($^\circ\text{C}$) | -30 | -10 | 0 | +20 | +40 | +70 |
|--|-------|-------|-------|-------|-------|-------|
| THERMAL CONDUCTIVITY ($\text{W/m}\cdot\text{K}$) | 0,033 | 0,034 | 0,035 | 0,037 | 0,038 | 0,040 |

The thermal conductivity values of various insulation material

| Material | λ ($\text{W/m}\cdot\text{K}$) | Density Kg/m^3 |
|-------------------------|---|-------------------------|
| ELASTOMERIC FOAM (FEF) | 0,040 | 50 |
| MINERAL WOOL (MV) | 0,045 | 30-100 |
| POLYURETHANE FOAM (PU) | 0,032-0,034 | 25-50 |
| POLYETHYLENE FOAM (PEF) | 0,040 | < 30 |
| CELLULAR GLASS (CG) | 0,045 | 100-125 |
| CALCIUM SILICATE | 0,060 | 250 |

The thermal conductivity of the materials in the table is evaluated at a mean temperature of $40 \text{ }^\circ\text{C}$.

Water vapour diffusion resistance factor μ

The water vapour diffusion resistance factor is defined by the symbol μ (MU) and is a measured value which determines the effectiveness of an insulating material to act as a barrier against water vapour transmission.

It is a fundamental parameter to assess the suitability of the insulating material for applications through which cold fluids flow: refrigeration and air-conditioning systems.

A high μ value will guarantee the effectiveness of the insulation material over a long period of time.

Usually, as regards thermal insulation materials and in particular elastomeric foam, resistance to water vapour transmission is linked to the following properties:

- A molecular structure with a high amount of closed cells (>90/95%)
- Small cell dimensions
- An excellent cohesion of the cell walls
- Consistent material thickness

To prevent the risk of condensation, the external surface temperature of the insulation material should be equal to or higher than the dew point temperature in the environment in which it is applied.

μ conversion factor in equivalent air thickness

The following formula illustrates how to determine the equivalent air layer thickness for a specific insulation material, taking into consideration that air, with a thermal conductivity λ value of approximately 0,020 W/m·K in normal conditions, is by far the most effective thermal insulator:

$SA = (\mu \times s)$ where the different parameters represent:

- SA = Equivalent air layer thickness (metres)
- μ = The water vapour diffusion resistance factor of the chosen insulation material
- s = Thickness (metres) of the chosen insulation material

Assuming that EUROBATEX elastomeric insulation material (with a water vapour diffusion resistance factor of $\mu \geq 7000$) is used, the equivalent air layer thicknesses obtained using the above formula are:

| | | | |
|--------------------------|-------|-------------------|--|
| EUROBATEX insulation thk | 6 mm | SA=7.000x 0,006 = | 42 meters of equivalent air layer thickness |
| EUROBATEX insulation thk | 9 mm | SA=7.000x 0,009 = | 63 meters of equivalent air layer thickness |
| EUROBATEX insulation thk | 13 mm | SA=7.000x 0,013 = | 91 meters of equivalent air layer thickness |
| EUROBATEX insulation thk | 19 mm | SA=7.000x 0,019 = | 133 meters of equivalent air layer thickness |
| EUROBATEX insulation thk | 25 mm | SA=7.000x 0,025 = | 175 meters of equivalent air layer thickness |
| EUROBATEX insulation thk | 32 mm | SA=7.000x 0,032 = | 224 meters of equivalent air layer thickness |
| EUROBATEX insulation thk | 40 mm | SA=7.000x 0,040 = | 280 meters of equivalent air layer thickness |
| EUROBATEX insulation thk | 50 mm | SA=7.000x 0,050 = | 350 meters of equivalent air layer thickness |
| EUROBATEX insulation thk | 60 mm | SA=7.000x 0,060 = | 420 meters of equivalent air layer thickness |

N.B.

It is useful to remember that water vapour diffusion resistance factor μ is purely a numeric parameter used to make calculations. Its value is not taken into consideration in formulas used to calculate thermal dispersions, vital for calculating the correct insulation material thicknesses to use in the various applications.

Rules for calculating insulation material thicknesses to avoid the formation of condensation on piping carrying low temperature fluids.

thickness calculations

In specific cases where fluids carried in the piping have temperatures lower than those of the external environment, together with the likely presence of ambient air humidity, the risk of condensation formation increases, harmful to energy saving and causing corrosion on the piping itself.

Therefore the insulation material has two purposes: to maintain energy saving and preserve and protect piping (exposed to the air and its humidity), ensuring that the external surface temperature is never lower than the dew point temperature of the environment.

To calculate the required insulation thickness, the following information is vital to be able to proceed with the necessary calculation, following the formula described below.

1. The temperature of the fluid in the system's piping.

2. The external ambient temperature

3. Ambient relative humidity

The correct thickness of the insulation material needs to be calculated to avoid condensation formation (basically, this calculation helps to obtain the value relative to the insulation applications on flat surfaces which however represent the maximum dispersed surfaces, and therefore the most difficult situations).

$$S = \frac{\lambda}{\alpha_a} \times \left(\frac{t_a - t_i}{t_a - t_r} - 1 \right)$$

Where:

- **S** = Thickness of the insulation material (expressed in metres).
- **λ** = Thermal conductivity of the specific insulation material expressed as **W/m·K** (the value obtained at the mean functioning temperature should be inserted).
- **α_a** = External surface coefficient expressed as **W/m²·K** (data obtained from the following table).
- **t_a** = Ambient temperature °C.
- **t_i** = Temperature of the fluid inside the piping °C.
- **t_r** = Air dew point temperature °C.

α_a reference values for the calculation

| Value | Type of ventilation |
|------------------------|-------------------------------|
| 5 W/m ² ·K | Poor |
| 9 W/m ² ·K | Normal (internal environment) |
| 15 W/m ² ·K | High (external environment) |

The value of (ta-tr) can be obtained from the first table, while the second table indicates the correct thickness of EUROBATEX insulation material required to avoid the formation of condensation.

thickness calculations

Table 1 - ta-tr values

| Air Temperature °C | Maximum Humidity g/m ³ | Permitted air cooling °C until the formation of condensation for relative humidity | | | | | | | | | | | | | | Maximum Humidity g/m ³ | Air Temperature °C |
|--------------------|-----------------------------------|--|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----------------------------------|--------------------|
| | | 30% | 35% | 40% | 45% | 50% | 55% | 60% | 65% | 70% | 75% | 80% | 85% | 90% | 95% | | |
| -20 | 0.90 | - | 10.4 | 9.1 | 8.0 | 7.0 | 6.0 | 5.2 | 4.5 | 3.7 | 2.9 | 2.3 | 1.7 | 1.1 | 0.5 | 0.90 | -20 |
| -15 | 1.40 | 12.3 | 10.8 | 9.6 | 8.3 | 7.3 | 6.4 | 5.4 | 4.6 | 3.8 | 3.1 | 2.4 | 1.8 | 1.2 | 0.6 | 1.40 | -15 |
| -10 | 2.17 | 12.9 | 11.3 | 9.9 | 8.7 | 7.6 | 6.6 | 5.7 | 4.8 | 3.9 | 3.2 | 2.5 | 1.8 | 1.2 | 0.6 | 2.17 | -10 |
| -5 | 3.27 | 13.4 | 11.7 | 10.3 | 9.0 | 7.9 | 6.8 | 5.8 | 5.0 | 4.1 | 3.3 | 2.6 | 1.9 | 1.2 | 0.6 | 3.27 | -5 |
| 0 | 4.8 | 13.9 | 12.2 | 10.7 | 9.3 | 8.1 | 7.1 | 6.0 | 5.1 | 4.2 | 3.5 | 2.7 | 1.9 | 1.3 | 0.7 | 4.8 | 0 |
| 2 | 5.6 | 14.3 | 12.6 | 11.0 | 9.7 | 8.5 | 7.4 | 6.4 | 5.4 | 4.6 | 3.8 | 3.0 | 2.2 | 1.5 | 0.7 | 5.6 | 2 |
| 4 | 6.4 | 14.7 | 13.0 | 11.4 | 10.1 | 8.9 | 7.7 | 6.7 | 5.8 | 4.9 | 4.0 | 3.1 | 2.3 | 1.5 | 0.7 | 6.4 | 4 |
| 6 | 7.3 | 15.1 | 13.4 | 11.8 | 10.4 | 9.2 | 8.1 | 7.0 | 6.1 | 5.1 | 4.1 | 3.2 | 2.3 | 1.5 | 0.7 | 7.3 | 6 |
| 8 | 8.3 | 15.6 | 13.8 | 12.2 | 10.8 | 9.6 | 8.4 | 7.3 | 6.2 | 5.1 | 4.2 | 3.2 | 2.3 | 1.5 | 0.8 | 8.3 | 8 |
| 10 | 9.4 | 16.0 | 14.2 | 12.6 | 11.2 | 10.0 | 8.6 | 7.4 | 6.3 | 5.2 | 4.2 | 3.3 | 2.4 | 1.6 | 0.8 | 9.4 | 10 |
| 12 | 10.7 | 16.5 | 14.6 | 13.0 | 11.6 | 10.1 | 8.8 | 7.5 | 6.3 | 5.3 | 4.3 | 3.3 | 2.4 | 1.6 | 0.8 | 10.7 | 12 |
| 14 | 12.1 | 16.9 | 15.1 | 13.4 | 11.7 | 10.3 | 8.9 | 7.6 | 6.5 | 5.4 | 4.3 | 3.4 | 2.5 | 1.6 | 0.8 | 12.1 | 14 |
| 16 | 13.6 | 17.4 | 15.5 | 13.6 | 11.9 | 10.4 | 9.0 | 7.8 | 6.6 | 5.5 | 4.4 | 3.5 | 2.5 | 1.7 | 0.8 | 13.6 | 16 |
| 18 | 15.4 | 17.8 | 15.7 | 13.8 | 12.1 | 10.6 | 9.2 | 7.9 | 6.7 | 5.6 | 4.5 | 3.5 | 2.6 | 1.7 | 0.8 | 15.4 | 18 |
| 20 | 17.3 | 18.1 | 15.9 | 14.0 | 12.3 | 10.7 | 9.3 | 8.0 | 6.8 | 5.6 | 4.6 | 3.6 | 2.6 | 1.7 | 0.8 | 17.3 | 20 |
| 22 | 19.4 | 18.4 | 16.1 | 14.2 | 12.5 | 10.9 | 9.5 | 8.1 | 6.9 | 5.7 | 4.7 | 3.6 | 2.6 | 1.7 | 0.8 | 19.4 | 22 |
| 24 | 21.8 | 18.6 | 16.4 | 14.4 | 12.6 | 11.1 | 9.6 | 8.2 | 7.0 | 5.8 | 4.7 | 3.7 | 2.7 | 1.8 | 0.8 | 21.8 | 24 |
| 26 | 24.4 | 18.9 | 16.6 | 14.7 | 12.8 | 11.2 | 9.7 | 8.4 | 7.1 | 5.9 | 4.8 | 3.7 | 2.7 | 1.8 | 0.9 | 24.4 | 26 |
| 28 | 27.2 | 19.2 | 16.6 | 14.9 | 13.0 | 11.4 | 9.9 | 8.5 | 7.2 | 6.0 | 4.9 | 3.8 | 2.8 | 1.8 | 0.9 | 27.2 | 28 |
| 30 | 30.3 | 19.5 | 17.1 | 15.1 | 13.2 | 11.6 | 10.1 | 8.6 | 7.3 | 6.1 | 5.0 | 3.8 | 2.8 | 1.8 | 0.9 | 30.3 | 30 |
| 35 | 39.4 | 20.2 | 17.7 | 15.7 | 13.7 | 12.0 | 10.4 | 9.0 | 7.6 | 6.3 | 5.1 | 4.0 | 2.9 | 1.9 | 0.9 | 39.4 | 35 |
| 40 | 50.7 | 20.9 | 18.4 | 16.1 | 14.2 | 12.4 | 10.8 | 9.3 | 7.9 | 6.5 | 5.3 | 4.1 | 3.0 | 2.0 | 1.0 | 50.7 | 40 |
| 45 | 64.5 | 21.6 | 19.0 | 16.7 | 14.7 | 12.8 | 11.2 | 9.6 | 8.1 | 6.8 | 5.5 | 4.3 | 3.1 | 2.1 | 1.0 | 64.5 | 45 |
| 50 | 82,3 | 22.3 | 19.7 | 17.3 | 15.2 | 13.3 | 11.6 | 9.9 | 8.4 | 7.0 | 5.7 | 4.4 | 3.2 | 2.2 | 1.0 | 82.3 | 50 |

Table 2 - Thicknesses of EUROBATEX in mm required to avoid condensation formation on flat surfaces.

| ta Ambient Temperature | + 15 °C | | | | | + 20 °C | | | | | + 25 °C | | | | | + 30 °C | | | | | + 35 °C | | | | | |
|-----------------------------|---------|----|----|----|----|---------|----|----|----|-----|---------|----|----|----|-----|---------|----|----|----|-----|---------|----|----|----|-----|-----|
| | U.R.% | 60 | 70 | 80 | 85 | 90 | 60 | 70 | 80 | 85 | 90 | 60 | 70 | 80 | 85 | 90 | 60 | 70 | 80 | 85 | 90 | 60 | 70 | 80 | 85 | 90 |
| Temperature of the fluid °C | +15 | - | - | - | - | - | - | - | - | 4 | 8 | - | - | 7 | 11 | 19 | - | 6 | 12 | 18 | 31 | 5 | 10 | 17 | 25 | 41 |
| | +10 | - | - | - | 4 | 8 | - | - | 7 | 12 | 20 | - | 6 | 13 | 19 | 31 | 6 | 10 | 18 | 26 | 42 | 7 | 12 | 22 | 32 | 51 |
| | +5 | - | - | 8 | 12 | 19 | - | 7 | 13 | 19 | 31 | 6 | 10 | 18 | 26 | 41 | 8 | 13 | 23 | 33 | 54 | 10 | 16 | 27 | 39 | 62 |
| | 0 | 4 | 7 | 13 | 20 | 31 | 6 | 10 | 18 | 27 | 43 | 8 | 13 | 23 | 33 | 52 | 10 | 16 | 28 | 40 | 64 | 12 | 19 | 33 | 46 | 73 |
| | -5 | 6 | 10 | 18 | 27 | 41 | 9 | 14 | 24 | 34 | 55 | 10 | 16 | 28 | 40 | 63 | 12 | 19 | 33 | 46 | 74 | 14 | 22 | 37 | 52 | 82 |
| | -10 | 8 | 13 | 23 | 33 | 51 | 11 | 17 | 28 | 41 | 64 | 13 | 20 | 34 | 48 | 74 | 15 | 22 | 38 | 53 | 85 | 16 | 25 | 41 | 58 | 91 |
| | -20 | 13 | 20 | 33 | 48 | 72 | 15 | 23 | 37 | 53 | 83 | 16 | 25 | 41 | 58 | 89 | 19 | 28 | 47 | 66 | 104 | 20 | 31 | 51 | 72 | 112 |
| -30 | 17 | 26 | 43 | 61 | 92 | 19 | 29 | 48 | 67 | 105 | 21 | 31 | 51 | 72 | 109 | 22 | 33 | 55 | 76 | 120 | 23 | 34 | 56 | 79 | 123 | |

The CE marking of elastomeric insulation materials and the normative references.

Introduction

The plan to reduce polluting emissions into the atmosphere on a world wide scale detailed during the KYOTO Conference in 1990 and was aimed at encouraging the Member Countries to adopt an adequate energy policy which, without penalizing environmental comfort could boost a sustainable growth, especially for developed countries.

The EU Member Countries (at that time actively involved in creating a more united "future") had already begun to introduce regulations and standards in various specific sectors with the aim to put into effect the decisions taken during the Kyoto Conference as quickly as possible.

Between the sectors identified as being those that could contribute both to energy saving and a reduction of emissions into the atmosphere, the construction industry, which consumes approximately 30% of the total energy, was targeted as being in need of swift intervention.

The 89/106/EEC Directive and the Regulation

The European Directive regarding construction products (89/106/EEC) was promulgated by the boards of experts who imposed fundamental parameters for materials used in this sector with the aim to guarantee safety and to possess efficient energy saving qualities.

In March 2011 the European Community approved the No. 305 Regulation published on April 4th 2011 in the official European Journal, which abrogated the above mentioned Directive, substituting it with the Regulation which became operational from 1 July 2013. The main aim was to guarantee, define all the conditions related to the commercialization of goods (free circulation in the EU) and to unify the administrative regulations in one single document, valid for all EU Member Countries.

NB.

The Regulation (CPR-Construction Product Regulation) is a law that came into force in all EU Member Countries without the necessity of a specific national transposition.

Also all main requirements of construction materials (together with those of insulation materials) have been included in the CPR and are stated in the table below:

| List of requirements specified by the 305/2011 Regulation | |
|---|---------------------------------------|
| Construction material | Insulation material |
| Mechanical resistance and stability | Thermal conductivity |
| Safety in the event of fire | Fire performance |
| Hygiene, health and environment | Water vapour diffusion |
| Safety and ease of use | Working temperature |
| Noise protection | Type of installation (installability) |
| Energy saving and heat retention | Health and safety |
| Sustainable use of natural resources | |

The CE marking of elastomeric insulation materials and the normative references.

The 89/106/EEC European Directive regarding construction products categorically states that specific standards should be harmonized for each type of product, in order to guarantee its proper use based on its technical properties, some of which are not comparable between different types already on the market.

The competent Technical Commission approved the European Standard EN 14304:2009+A1:2013 for elastomeric insulation material; the standard was published in the Official Journal of the European Union and is compulsory in order to gain a CE Marking.

The following tables have the purpose of supplying those who work in this sector with useful information regarding its contents and required conditions.

EUROPEAN STANDARD - EN 14304:2009 + A1:2013 Thermal insulation products for building equipment and industrial installations. Factory made flexible elastomeric foam (FEF) products.

Regulations and compliances

The main characteristics of elastomeric products for thermal insulation taken into consideration by the Standard are:

- Thermal conductivity
- The dimensions and the Dimensional tolerances
- Dimensional stability
- Fire behaviour
- The minimum and maximum working temperatures
- Water absorption
- Resistance to water vapour
- Solubility and pH value
- Sound absorption
- Release of harmful substances



The CE marking of elastomeric insulation materials and the normative references.

The characteristics highlighted in the previous table are analysed in greater depth on the following pages since they are considered to be both important and useful for those who work in this sector.

Thermal conductivity

This is considered as being the distinguishing characteristic of insulation material and is defined by the symbol λ (lambda), and is measured in $W/m\cdot K$; the product with the lowest value will have the highest insulating capacity.

Usually a material with a thermal conductivity value lower than $0,100 W/m\cdot K$ is defined as an “insulating” material;

The European Standard states that the thermal conductivity value for elastomeric insulation material should not be greater than $0,050 W/m\cdot K$; at a mean working temperature of $10\text{ }^\circ C$.

This value is determined by tests specified by the regulations:

- EN 12667 for flat surfaces (sheets) and EN 12939 (for thickness)
- EN ISO 8497 for cylindrical products (pipes)

It is defined for the complete application temperature range of the product (with a minimum limit of $-170\text{ }^\circ C$). Tests on pipes are normally carried out on those with diameters ranging from 22 and 42 mm, taking into consideration the minimum and maximum thicknesses produced.

If different thicknesses are produced, the manufacturer is given the possibility to declare a single thermal conductivity value which should be the highest after having carried out the specific tests. This value will characterize the entire range.

Dimensional tolerances

These are determined by the Standards: EN 822 and EN 823 for sheets, rolls and tapes and EN 13467 for tubes.

A summary of the limitations is stated in the following table:

Dimensions in mm.

| Form of delivery | Length | Width | Thickness | | Squareness | Inside diameter | |
|------------------|----------------|-----------|--------------------|----------------|-------------------------|---------------------------------------|---------------------------------------|
| | | | Declared | Tolerance | | $D_i \leq 100$ | $D_i > 100$ |
| Tubes | $\pm 1,5\%$ | - | $d_D \leq 8$ | ± 1 | 3,0 mm | $D_{iD} + 1 \leq D_i \leq D_{iD} + 4$ | $D_{iD} + 1 \leq D_i \leq D_{iD} + 6$ |
| | | | $8 < d_D \leq 18$ | $\pm 1,5$ | - | | |
| | | | $18 < d_D \leq 31$ | $\pm 2,5$ | - | | |
| | | | $d_D > 31$ | ± 3 | - | | |
| Sheets | $\pm 1,5\%$ | $\pm 2\%$ | $d_D \leq 6$ | ± 1 | 3,0 mm/m (length/width) | - | - |
| | | | $6 < d_D \leq 19$ | $\pm 1,5$ | - | | |
| | | | $d_D > 19$ | ± 2 | 3,0 mm (thickness) | | |
| Rolls | + 5% - 1.5% | $\pm 2\%$ | $d_D \leq 6$ | ± 1 | 3,0 mm/m (length/width) | - | - |
| | | | $6 < d_D \leq 19$ | $\pm 1,5$ | - | | |
| | | | $d_D > 19$ | ± 2 | 3,0 mm (thickness) | | |
| Tapes | + 5% - 1.5% | $\pm 2\%$ | $d_D = 3$ | - 0.1 + 1,5 | - | - | - |

Key: D_i = inside \emptyset D_{iD} = nominal inside \emptyset (Ref. Tubes) d_D = Nominal thickness

The CE marking of elastomeric insulation materials and the normative references.

Fire behaviour

In order to harmonise and regulate one of the most important aspects regarding environmental safety on a European level (the fire behaviour of building products, including insulation material), the regulations specified in the table have been introduced to analyse and measure the parameters of: flammability, the production of smoke, heat development and dripping.

Test regulation and European classification

| | |
|----------------|--|
| EN 13501-1 | Fire classification of building products. Part 1 Fire behaviour |
| EN 13238 | Conditioning procedures |
| EN ISO 1182 | Non-combustibility test |
| EN ISO 1716 | Calculation of calorific values |
| EN ISO 11925-2 | Flammability of construction products in direct contact with flame |
| EN 13823 | Fire behaviour test for construction products excluding floors (S.B.I. test) |
| EN ISO 9239-1 | Fire behaviour test for floors (radiant panel) |

Table of the tests and designations required for behaviour to fire classes for construction products








| Construction products | | | | Floors | | Linear products | |
|-----------------------|------------------------------|---|--|------------------|------------------------------|-----------------|----------------------------------|
| Class | Test method | Classification criteria | Additional classification | Class | Test method | Class | Test method |
| A1 | EN ISO 1182 + | $\Delta T \leq 30 \text{ }^\circ\text{C}$ $\Delta m \leq 50 \%$ $t_t \leq 0$ (non-persistent fire) | | A1 _{FL} | EN ISO 1182 + | A1 _L | EN ISO 1182 + |
| | EN ISO 1716 | $PCS \leq 2,0 \text{ MJ. Kg}^{-1}$ $PCS \leq 2,0 \text{ MJ. Kg}^{-1}$ $PCS \leq 2,0 \text{ MJ. m}^{-2}$ $PCS \leq 2,0 \text{ MJ. Kg}^{-1}$ | | | EN ISO 1716 | | EN ISO 1716 |
| A2 | EN ISO 1182 | $\Delta T \leq 50 \text{ }^\circ\text{C}$ $\Delta m \leq 50 \%$ $t_t \leq 20\text{s}$ | | A2 _{FL} | EN ISO 1182 + | A2 _L | EN ISO 1182 + |
| | EN ISO 1716 + | $PCS \leq 3,0 \text{ MJ. Kg}^{-1}$ $PCS \leq 4,0 \text{ MJ. Kg}^{-2}$ $PCS \leq 4,0 \text{ MJ. m}^{-2}$ $PCS \leq 3,0 \text{ MJ. Kg}^{-1}$ | | | EN ISO 1716 | | EN ISO 1716 |
| | EN 13823 (SBI) | $FIGRA \leq 120 \text{ W. s}^{-1}$ LSF < sample margin $THR_{600s} \leq 7,5 \text{ MJ}$ | Smoke production and burning particles | | EN ISO 9239-1 | | UNI EN 13823 (SBI) |
| B | EN 13823 (SBI) + | $FIGRA \leq 120 \text{ W. s}^{-1}$ LSF < sample margin $THR_{600s} \leq 7,5 \text{ MJ}$ | Smoke production and burning particles | B _{FL} | EN 13823 (SBI) + | B _L | UNI EN 13823 (SBI) + |
| | EN ISO 11925-2 exposure =30s | $F_s \leq 150 \text{ mm within 60s}$ | | | EN ISO 11925-2 exposure =30s | | UNI EN ISO 11925-2 exposure =30s |
| C | EN 13823 (SBI) + | $FIGRA \leq 250 \text{ W. s}^{-1}$ LSF < sample margin $THR_{600s} \leq 15 \text{ MJ}$ | Smoke production and burning particles | C _{FL} | EN 13823 (SBI) + | C _L | UNI EN 13823 (SBI) + |
| | EN ISO 11925-2 exposure =30s | $F_s \leq 150 \text{ mm within 60s}$ | | | EN ISO 11925-2 exposure =30s | | UNI EN ISO 11925-2 exposure =30s |
| D | EN 13823 (SBI) + | $FIGRA \leq 750 \text{ W. s}^{-1}$ | Smoke production and burning particles | D _{FL} | EN 13823 (SBI) + | D _L | UNI EN 13823 (SBI) + |
| | EN ISO 11925-2 exposure =30s | $F_s \leq 150 \text{ mm within 60s}$ | | | EN ISO 11925-2 exposure =15s | | UNI EN ISO 11925-2 exposure =30s |
| E | EN ISO 11925-2 exposure =15s | $F_s \leq 150 \text{ mm within 60s}$ | Smoke production and burning particles | E _{FL} | EN ISO 11925-2 exposure =15s | E _L | UNI EN ISO 11925-2 exposure =15s |
| F | Reaction not determined | | | F _{FL} | Reaction not determined | F _L | Reaction not determined |

The CE marking of elastomeric insulation materials and the normative references.

Fire behaviour



Euroclass - application table

| Fire behaviour classes | | Smoke classes | | Dripping classes | | | | |
|------------------------|---|------------------|---|------------------|---|---|-----------|---|
| A1 | Incombustible | No test required | | No test required | | | | |
| A2 |  Non-combustible | s1 |  Limited or absent | d0 | Absent for the first 10 minutes | | | |
| B |  | s2 |  Present | d1 |  Low dripping of flaming material for less than 10 seconds during the first ten minutes | | | |
| C | Level of combustion increasing from class B to class E | | | | |  Significant | d2 |  Significant |
| D | | | | | | | | |
| E | | | | | | | | |
| F | No test required | | | | | | | |

The CE marking of elastomeric insulation materials and the normative references.

In the specific case of elastomeric foam products (usually belonging to the organic material family) the best fire behaviour classification obtained is class B.

N.B:

In the new european classification for classes from A2 to E, additional characteristics are requested that are marked by the letters:

s = smoke

d =dripping

and should be added to the initial classification.

If tests are carried out separately on linear piping or floors, the initial classification will have a subscript L or FL as indicated below:

B_L (tubes)

B_{FL} (floors)

Resistance to water vapour diffusion

Characterized by the symbol μ (mu) with its property determined by the European Standards:

EN 12086 - For flat products

EN 13469 - For cylindrical products

Alternatively it can be determined by the European Standard EN ISO 10456

The value should be indicated at intervals of 1000 to a maximum of 15000 and should never be less than the declared value, (this value should always be preceded by the symbol \geq greater or identical), as shown in the following table:

| Level (μ) | Declared value (μ) |
|-----------------|--------------------------|
| 1000 | ≥ 1000 |
| 2000 | ≥ 2000 |
| 3000 | ≥ 3000 |
| 4000 | ≥ 4000 |
| ↓ 15000 | ↓ ≥ 15000 |

Traces of soluble ions in the water, PH value, release of harmful substances (halogens)


The traces of CHLORIDE- FLUORIDE - SILICATE - SODIUM ions (that can cause possible corrosion of metal piping) together with the product's PH value, are evaluated based on the European Standard EN 13458.

Traces of halogens (chlorine, fluorine, bromine, iodine) are determined based on the European Standard DIN/VDE 472-815. An elastomeric product can only be defined as being halogen free (halogen free) if its content percentages based on weight are:

- less than 0,2% (the total of its chlorine, bromine and iodine content)
- less than 0,1% for fluorine

The CE marking of elastomeric insulation materials and the normative references.

Examples of CE labelling

| | |
|--|--|
|  | CE conformity marking, consisting of the "CE" - symbol given in Directive 93/68/EEC. |
| 01234 | Identification number of the certification body (for products under system 1). |
| AnyCO Ltd, PO Box 21 B-1050 | Name or identifying mark and registered address of the producer. |
| 13 | Two last digits of the year for affixing CE marking (ITT). |
| 01234-CPD-00234 | Certificate number (for products under system 1). |
| EN 14304:2009+A1:2013 | No. of dated version of European Standard. |
| Flexible Elastomeric Foam, intended to be used as thermal insulation product for building equipment and industrial installations. Reaction to fire - Class B Thermal conductivity see Manufacturer's Literature. | Description of the product and Information on regulated characteristics. |
| FEF - EN - 14304 - ST(+) 115 - ST(-) 200 - MU 7000 - CL 1 | Designation code (in accordance with Clause 6 for the relevant characteristics according to Table ZA.1). |

CE Marking (explanation of references are supplied on the product's labelling)

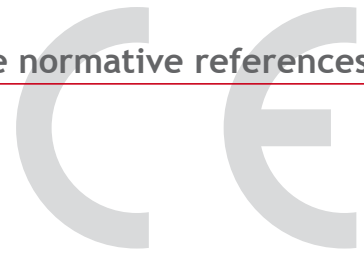
| | | | |
|---|--|--|---|
| FEF - EN-14304: reference to the product standard regarding elastomers. | ST (+)-ST (-): maximum and minimum working temperatures. | MU 7000: Diffusion coefficient of water vapour value | CL1: quantity of chloride ions soluble in water |
|---|--|--|---|

Type of products applicable to CE Markings

(Ref. attached IV-Table 1 - European regulation 305/2011)

As for the CPR concerning building products, the specific references regarding the application of insulation materials are summarized below.

| Area code | Type of product |
|-----------|--|
| 4 | Products for thermal insulation Composite insulation kits/systems |
| 27 | Heating appliances |
| 28 | Ducts, tanks and accessories that do not come into contact with water for human consumption. |
| 34 | Kits for buildings, units, prefabricated structures |



Documentation relevant to CE Markings

Apart from the labelling previously illustrated, the documents accompanying the CE Trademark (updated when the European Regulation came into force) are as follows:

The product's Certificate of Constancy of Performance (substituting the Certificate of Conformity) released by the notified Body.

**Declaration of Performance (DoP) released by the manufacturer, accompanied by the safety data sheet in accordance with the EU Regulation No.1907/2006 (Reach).
NB: according to Reach regulation, the Safety Data Sheet is not mandatory for FEF/PEF products.**

Summary of the european standards for materials used for the insulation of systems.

In order to supply adequate information, the following table lists the standards for each type of insulation product. Those which concern the UNION FOAM S.p.A. products are highlighted.

EN 14303 Thermal insulation material for applications in buildings and industrial installations. Factory made mineral wool (MW) products.

EN 14304 Thermal insulation products for building equipment and industrial installations. Factory made flexible elastomeric foam (FEF) products.

EN 14305 Thermal insulation material for applications in buildings and industrial installations. Factory made cellular glass (CG) products.

EN 14306 Thermal insulation material for applications in buildings and industrial installations. Factory made calcium silicate (CS) products.

EN 14307 Thermal insulation material for applications in buildings and industrial installations. Factory made extruded polystyrene foam (XPS) products.

EN 14308 Thermal insulation products for building equipment and industrial installations. Factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products.

EN 14309 Thermal insulation material for applications in buildings and industrial installations. Factory made polystyrene foam (EPS) products.

EN 14313 Thermal insulation products for building equipment and industrial installations - Factory made polyethylene foam (PEF) products.

EN 14314 Thermal insulation material for applications in buildings and industrial installations. Factory made phenolic resin foam (PF) products.



Comparison between CPD (Directive) and CPR (Regulation)

Evaluation systems for performance consistency

The EU No. 305/2011 Regulation (CPR) abrogated, substituted and integrated the 89/106/EEC (CPD) Directive from 01/07/2013 with the following differences.

| Characteristics | |
|--|--|
| 89/106/EEC (CPD) Directive | EU No. 305/2011 (CPR) Regulation |
| Application: OPTIONAL Systems: 1+, 1,2, 2+, 3, 4 | Application: COMPULSORY Systems: 1+, 1,2+, 3, 4 |
| Document Type | |
| Declaration of Conformity CE Certificate of Conformity | Declaration of performance Certificate of Constancy of Performances |
| European Technical approval (ETA) | European Technical evaluation (ETA) |
| 6 essential requisites of the works | 7 essential requisites of the works |

a) Basic requirements for construction work, according to the EU No.305/2011 (CPR) Regulation

1. Mechanical resistance and stability
 2. Safety in case of fire
 3. Hygiene, health and the environment
 4. Safety and accessibility in use
 5. Protection against noise
 6. Energy economy and heat retention
 7. Sustainable use of natural resources
- Compared to the 89/106 CEE (CPD) Directive, point No. 7 has been added.

b) Assessment and verification of constancy of performance (AVCP)

Defined by the EU No. 305/2011 (CPR) Regulation for construction products, these specify the tests to be carried out by the manufacturer on finished products.

The assessment of the characteristics and the process of measuring its performance is defined by the specific product standard.

There are 5 evaluation systems stipulated by the EU Regulation which are described in the Product Standards in order to obtain the CE Marking:

(4) - (3) - (2+) - (1) - (1+)



From system 4 to system 1+
Greater guarantee of quality

System 1+




The **System 1+**, in accordance with the EU Regulation, makes further verifications compared to those for system 1, and also requires tests to be carried out by the Notified Bodies on samples taken from the manufacturing plant.

It is currently optional since it has not been included in the product regulations.

UNION FOAM S.p.A. chose GSH - CELLE D-29227 as its Notified body and thanks to the RAL Quality Mark guarantees and meets the requirements outlined in system (1+), ensuring its clients a higher degree of product quality.

Summary of the regulations

ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCER - AVCP SYSTEMS (EU REGULATION No. 305/2011 - CPR)

| TRADEMARK | TYPE | DOCUMENT | TASKS | |
|---|--|---|---|---|
| | | | MANUFACTURER | NOTIFIED BODY |
|  |  | RAL certificate of quality | Control of factory production. Complementary tests on samples taken from the production plant of the manufacturer following a specific control programme. | Initial product tests. Initial inspection of the factory and its production control procedures. Monitoring, evaluation and permanent approval of the factory's production control. Tests carried out by the Notified Body on samples taken from the factory. |
|  | 1 | Certificate of performance consistency. Declaration of product's performance (DOP) | As system 1+ | As system 1+ but without tests carried out by the Notified Body on samples taken from the factory. |
| | 2+ | Declaration of product's performance (DOP) | Initial product tests. Production control in the factory. Possible tests of samples taken from the factory following a specific control programme. | Certification of factory production control depending on the initial inspection of the factory and its production control. Monitoring, evaluation and permanent approval of the factory's production control. |
| | 3 | Declaration of product's performance (DOP) | Production control in the factory. | Initial product tests. |
| | 4 | Declaration of product's performance (DOP) | Initial product tests. Production control in the factory. | |



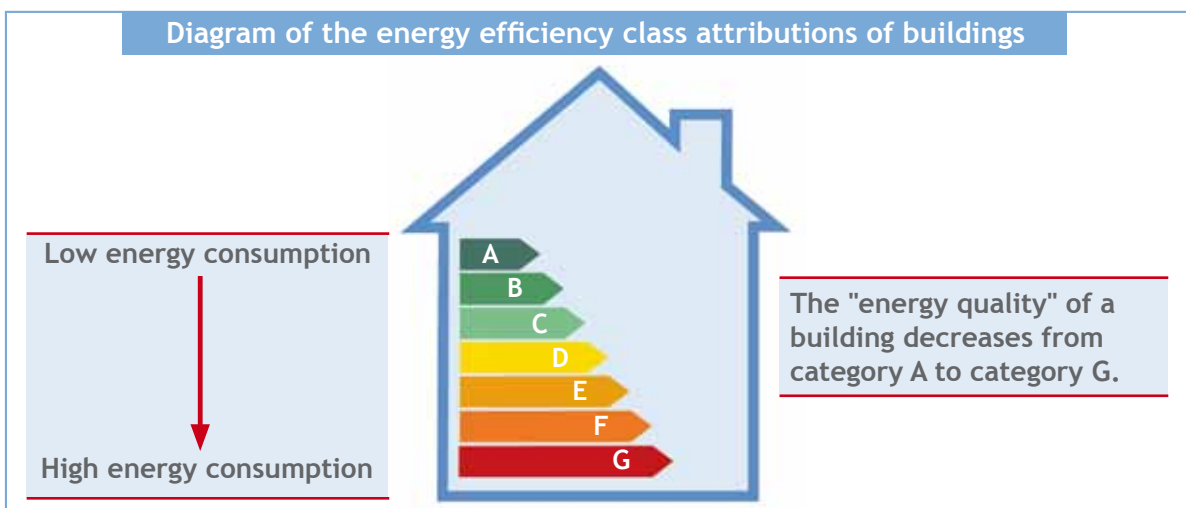
The environmental sustainability of buildings

environmental sustainability of buildings

Introduction

In an era of renewed politics to safeguard the environment and its natural resources, strongly linked to construction and protection of buildings and as well as the need to continuously finalize Energy Performance Certificates, it is possible to study and promote the environmental sustainability of the buildings themselves through the following protocols. The table illustrates the main features of the two types of certificates, aimed, as well as an improved management of traditional energy sources, at guaranteeing adequate personal and environmental protection.

| Comparison of the 2 systems | |
|---|---|
| ENVIRONMENTAL CERTIFICATION | ENERGY PERFORMANCE CERTIFICATE |
| <p>Declares the performance (and environmental impacts on health) of the building, including energy consumption.</p> <p>IT IS VOLUNTARY (It could become obligatory if required)</p> <ul style="list-style-type: none"> • Needed to take advantage of tax incentives <ul style="list-style-type: none"> • For public buildings • For ERP buildings • For new public tenders | <p>Declares, through a class of attributed energy consumption (in KWh/mq year) in order to evaluate performance. Energy consumption increases starting from cat. A up until cat. G (see diagram)</p> <p>IT IS OBLIGATORY</p> <ul style="list-style-type: none"> • For new buildings (Public and/or Private) • To take advantage of tax incentives • For deeds of sale |



Protocols for the certification of the environmental sustainability of buildings

List of world wide protocols:

| | |
|------------------------|----------------------------------|
| ● BREEM - ENGLAND | INBAR - ITALY |
| BLUE ANGEL - GERMANY | ITACA - ITALY |
| CASACLIMA - ITALY | ● LEED GBC - UNITED STATES |
| ● CASBEE - JAPAN | MINERGIE ECO - SWITZERLAND |
| ECOLABEL - EUROPE | QUALITEL - FRANCE |
| GREEN STAR - AUSTRALIA | SB100 ANAB - ITALY |
| HQE - FRANCE | SWAN ECOLABELLING - NORTH EUROPE |

- The most widespread on a world wide scale are **LEED GBC**, **BREEM** and **CASBEE**.

The diffusion of the protocols in Italy is carried out by:

| |
|---|
| ITACA - the most widespread on a national level |
| LEED (GBC Italia) - in the Lombardy Trentino A.A. regions |
| CASACLIMA - Trentino A.A. |

The environmental sustainability of buildings

Features of the ITACA and LEED protocols: analysis and differences

a) ITACA protocol

The ITACA Protocol is a system for the certification of the level of environmental sustainability of buildings of different uses. It is promoted by the Italian Regions and managed by a specific committee with representatives of the regions with the participation of the iiSBE Italy and ITC-CNR associations. The protocol is based on the SBMethod, chosen in 2002 as a reference by the Italian regions.

- Homes ● Offices ● Shopping centres ● Industrial buildings

The analysis and evaluation was made based on specific tables based on predetermined criteria necessary to give buildings a score (see following table) which will identify the respected requirement.

Analysing and evaluating with the appropriate tables:

CONSUMPTION OF RESOURCES (Referring to energy and material consumption and the performance of its envelope)

THE QUALITY OF THE INTERNAL ENVIRONMENT (Thermo-hygrometric and acoustic comfort)

THE QUALITY OF THE SERVICE (The maintenance of performances during the operational phase)

| SCORE | THE BUILDING'S REQUIREMENT |
|-------|---|
| -1 | Inferior performance of the standard practice |
| 0 | Minimum acceptable performance (see current regulations) |
| 1 | Minor improvement compared to point 0 |
| 2 | Significant improvement compared to point 0 |
| 3 | Major improvement compared to point 0 (best practice) |
| 4 | Substantial increase of the best practice of point 3 |
| 5 | Notable performance and of an advanced level compared to the best practice of point 3 |

Increasing "environmental quality" ↓

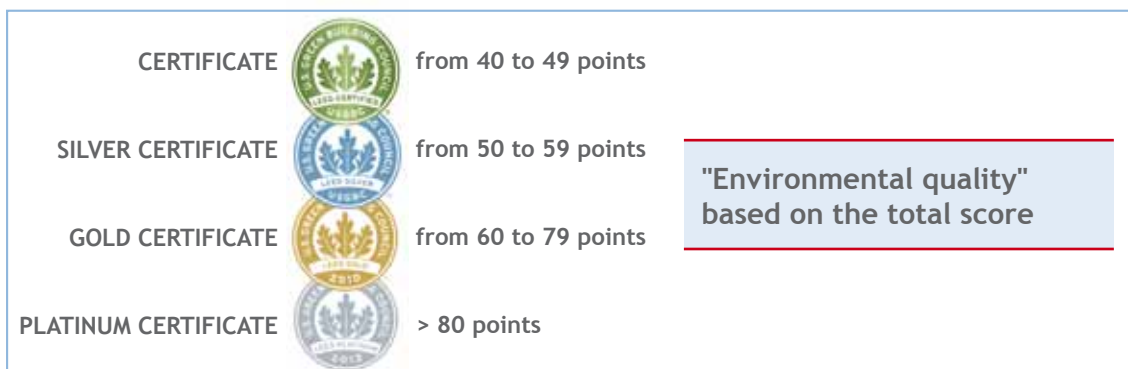
b) LEED Protocol

This is the most widespread system on a world wide scale for the verification and certification of the environmental sustainability of buildings; in Italy it is promoted by **GBC ITALIA** and adapted to the national situation. It consists of a rating system which allocates points in 7 specific areas and identifies both the obligatory prerequisites needed to obtain the certification of buildings and those which are optional which are necessary to obtain a higher classification level.

The reference areas are as follows:

- Sustainability of the site
- Water
- Energy and atmosphere
- Materials and resources
- Quality of the internal environment
- Innovation
- Regional and/or local peculiarities (these are necessary to increase the score obtained in the previous areas)

The scores and relative certifications are described in the following diagram:



c) Table of the differences between the two protocols:

ITACA Protocol

Greater importance is given to :

- consumption
- CO2 emissions
- management and maintenance of the building

LEED Protocol

Construction phase with points-based, allocation system for:

- impact on environmental repercussions
- waste production
- emission of harmful substances

N.B.: In the evaluation and quantification of the environmental sustainability of a building, insulation material can play an important role in improving energy efficiency and acoustic performance, contributing to a higher score and therefore a higher certification, even if they are not taken into consideration in the points-based allocation system of the protocols.

Railway applications

Fire safety in railway rolling stock (amendment to the european standard)

railway applications

The aim of this report is to supply some information regarding the EN 45545 Regulation which, in the May 2013 edition, defined the technical specifications related to fire safety in railway rolling stock. It needed to be accepted and published by the Member States within September 2013 with the obligation to revoke the present norms within March 2016.

It included the following seven points:

- General description.
- Requirements for fire behaviour of material and components.
- Fire resistance requirements of fittings.
- Fire resistance requirements for railway rolling stock material (planning).
- Fire resistance requirements for electrical equipment, including those installed on board trolleybuses, buses and magnetic-levitation vehicles.
- Fire control and suppression systems.
- Safety requirements for gas and flammable liquid installations.

We will analyse Point 1 (general description) and point 2 (relating to the fire behaviour characteristics of material and components that are installed in railway vehicles) in greater detail.

In general, there are 3 specific topics that represent the basis of the regulation, and are as follows:

- 1- The operational categories and their risk levels.
- 2- The test methods (still predominantly related to the standards already applicable to the shipbuilding and civil sectors).
- 3- The evaluation of essential parameters for a correct definition of results.

1. The operational categories and risk levels

Table of details

| Type of service | Risk Level | Operative Categories | Type of evacuation |
|---|------------|----------------------|---|
| National lines, regional, urban | HL 1 | OC 1 | Immediate stopping/fast evacuation. |
| Urban and suburban lines Stretches in tunnels and underground | HL 2 | OC 2 | Stopping at the nearest station. Slower evacuation. |
| National and regional lines Stretches in tunnels and underground | HL 3 | OC 3 | Stopping at the nearest station or in available lateral platforms. |
| National, regional and urban lines | HL 4 | OC 4 | Extremely difficult evacuation due to lack of lateral platforms. |

Railway applications

Fire safety in railway rolling stock (amendment to the european standard)

2. Test Methods

Taking into consideration the following parameters it is possible to determine the FCE (Fire Critical Effect):

Flammability - Fire diffusion - Heat emission - Opacity of smoke - Smoke toxicity

Through the tests shown below it is possible to define a value for a specific time in which evacuation is impossible if no other assistance is available. Naturally each above-mentioned parameter has its own reference value.

| SPECIFICATIONS OF THE TESTING SYSTEMS | | |
|---------------------------------------|---|--|
| Parameter | Type of control | Reference standards |
| Non-combustibility | Fire persistence and mass loss (through an increase in temperature of the furnace from 750 °C) | EN ISO 1182 |
| Lateral fire spread | Critical heat flux at which the flame extinguishes | ISO 5658-2 |
| Cone calorimeter (heat release) | Determination of MAHRE value in kW/m ² (with radiation of 25/50 in kW/m ²) | ISO 5660-1 |
| Smoke development (opacity) | Determination of Dm, Ds4, VOF4 values (for different radiations in the absence or presence of flame) | ISO 5659-2 |
| Gas Toxicity | Sample of gas taken in dynamic conditions in the smoke room. FTIR analysis and determination of time for CIT=1. Alternatively the AFNOR NF X 70-100 can be used (Tube furnace at 600 °C and discontinued analysis of combustion gases) | ISO 5659-2+FTIR ISO CD 21489 ISO 19702 |
| Heat release for seats | Determination of MAHRE by means of a 3 minutes exposure to the flame of a burner with a power of 7 kW | NT FIRE 032 ISO 9705 |
| Limiting Oxygen Index (LOI) | Measurement of the percentage of oxygen that when mixed could activate combustion | EN 4589-2 |

Explanation of symbols: **MAHRE** = heat release rate

Dm = maximum value of the optical density of smoke

Ds4 = value of optical density after 4 minutes from the beginning of the test

VOF4 = expressed in minutes, this is the value of smoke opacity (at 4 minutes) in the area represented by the Ds-time curve (from 0 to 4 minutes)

CIT = conventional Toxicity Index (determined by the relationship $C_i/IDHL$ where C_i is the medium concentration of each gas and IDHL represents the concentration which correspond to 30 minutes to determine human incapacity.

Table of IDHL values for gas types in mg/mc.

| Gas type | | Value | |
|-----------------|-------------|-----------------|-----------------------|
| CO ₂ | 72000 mg/mc | SO ₂ | 262 mg/m ³ |
| CO | 1380 mg/mc | HF | 25 mg/m ³ |
| HCN | 55 mg/mc | HBr | 99 mg/m ³ |
| NOx | 38 mg/mc | HCl | 75 mg/m ³ |

List of the elements to be tested

1 Structural - Internal - External - Furnishings
- Electrical and mechanical equipment

2 Electrical material, electronic and mechanical
(Situated inside the vehicles)

The requirements for mechanical material are: LOI, Dm and CIT as shown in the table below

| RISK LEVEL | LOI value | | Dm value | | CIT value | |
|------------|-----------|----------|----------|----------|-----------|----------|
| | Internal | External | Internal | External | Internal | External |
| 1 | 28 | 28 | 600 | - | 4 | - |
| 2 | 28 | 28 | 300 | 600 | 2 | 4 |
| 3 | 28 | 28 | 300 | 600 | 2 | 4 |
| 4 | 32 | 32 | 150 | 300 | 1 | 2 |

Railway applications

Fire safety in railway rolling stock (amendment to the european standard)

The following tables illustrate:

A) The risk level assessment for each type of vehicle. Level HL 4 is not included as it is not considered valid in terms of safety.

| Fire risk classification | | | | |
|--------------------------|----------------------|---|-------------------------|--|
| Operational Category | Type of vehicle | | | |
| | N: Standard vehicles | A: Vehicles belonging to an automatic train without trained staff on board. | D: Double-deck vehicles | S: Vehicles equipped with sleeping facilities. |
| 1 | HL1 | HL1 | HL1 | HL2 |
| 2 | HL2 | HL2 | HL2 | HL2 |
| 3 | HL2 | HL2 | HL2 | HL3 |
| 4 | HL3 | HL3 | HL3 | HL3 |

B) Regarding risk levels, the standard defines the values of single parameters based both on application and the specific required tests.

Material requirements

| Material requirements (No. relevant to the product) | Test method | Parameter and unit | Level | HL1 | HL2 | HL3 |
|---|---|---------------------------------------|---------|-----------|-----------|-----------|
| R1 (IN1A; IN1B; IN1D; IN1E; IN4; IN5; IN6; IN7; IN8; IN9B; IN11; IN12A; IN12B; IN14; F5) | T02 ISO 5658-2 | CFE kWm ⁻² | Minimum | 20 (a) | 20 (a) | 20 (a) |
| | T03.01 ISO 5660-1: 50 kWm ⁻² | MARHE kWm ⁻² | Maximum | - (a) | 90 | 60 |
| | T10.01 EN ISO 5659-2: 50 kWm ⁻² | D _s (4) non-dimensional | Maximum | 600 | 300 | 150 |
| | T10.02 EN ISO 5659-2: 50 kWm ⁻² | VOF _s min | Maximum | 1200 | 600 | 300 |
| | T11.01 EN ISO 5659-2: 50 kWm ⁻² | CIT _G non-dimensional | Maximum | 1,2 | 0,9 | 0,75 |

(a): If drops or particles are reported during the ISO 5658-2 test or in cases where the material does not catch fire and are therefore non-classifiable, the following requisites are added:

-The EN ISO 11925-2 test (subjected to direct flame for 30 seconds)
the material is considered acceptable if: flame spread < 150 mm within 60 seconds, no dripping and/or incandescent particles.

| The codes in the first column of the table correspond (for internal applications) to: | |
|--|---|
| IN 1A - vertical internal surfaces (insulation material and internal surface of the body) | IN 7 - doors and windows |
| IN 1B - horizontal internal surfaces facing the floor (insulation material and internal surface of the body) | IN 8 - curtains and parasols |
| IN 1D - internal surfaces with cavities | IN 9B - tables and folding tables |
| IN 1E - external covered surfaces containing technical equipment | IN 11 - bins and ashtrays |
| IN 4 - areas for luggage storage | IN 12A and IN 12B - internal and external surfaces of air ducts |
| IN 5 - driver's area | IN 14 - passenger information devices |
| IN 6 - internal surfaces of the gangways | F 5 - lower surfaces of sleeping wagons and beds |

Railway applications

Fire safety in railway rolling stock (amendment to the european standard)

Shown below an example of classification report for railway applications according to EN 45545.

CSI

EM 104
 Certificazione e Testing
 Viale Cassale
 Casale Monferrato, 11
 12050 Casale Monferrato
 Direzione: 0112 / 43000
 Info: 0112 / 43001
 Fax: 0112 / 43002
 E-mail: info@csi.it
 www.csi.it

**RAPPORTO DI CLASSIFICAZIONE
 CLASSIFICATION REPORT
 0753DCREA/13_2**

Reporto di classificazione di sistemi di fuoco del prodotto / **Eurofoam HF**
 Reaction or fire classification report of product

Descrizione / **vedi pagina 2**
 Description / **See page 2**

Per conto di / On behalf of / **UNION FOAM S.p.A.**
 Indirizzo / Address / **Via Dell'Industria, 11
 20048 Belluno (MI)**

Norma tecnica / **EN 45545-2:2013 - Applicazioni ferroviarie - Protezione al fuoco per i veicoli ferroviari - Parte 2: Requisiti per il comportamento al fuoco di materiali e componenti**
 Technical standard / **EN 45545-2:2013 - Railway applications. Fire protection on railway vehicles. Requirements for fire behaviour of materials and components**

Data / Date / **05/06/2013**

IMQ

CSI

RAPPORTO DI CLASSIFICAZIONE / CLASSIFICATION REPORT 0753DCREA/13_2
 Data / Date: 05/06/2013

1. DATI GENERALI / GENERAL DATA
 Identificazione della norma di riferimento / Standard/reference identification:
 - EN 45545-2:2013 - Applicazioni ferroviarie - Protezione al fuoco per i veicoli ferroviari - Parte 2: Requisiti per il comportamento al fuoco di materiali e componenti
EN 45545-2:2013 - Railway applications. Fire protection on railway vehicles. Requirements for fire behaviour of materials and components
 - ISO 5658-2:2002 - Reazione-to-fire tests - Heat release, smoke production and mass loss rate heat release rate (cone calorimeter method)
 - ISO 5658-2:2006/AmD 1:2011 - Reaction to fire tests - Spread of flame Guidance on flame spread
 - ISO 5659-2:2002 - Plastics - Smoke generation - Part 2: Determination of optical density by a single-chamber test

2. IDENTIFICAZIONE DELLE PROCEDURE / PROCEDURES IDENTIFICATION
 - Procedura normalizzata / Standard procedure: **M / Fin**
 - Controllo calcoli / Calculation check: **M / Fin**

3. DETTAGLI DEL PRODOTTO CLASSIFICATO / DETAILS OF CLASSIFIED PRODUCT
 3.1. Natura e impiego / Nature and use application:
 Il prodotto Eurofoam HF è definito come un materiale isolante - INIA / ENH / INIC (superfici interne, verticali/orizzontali con faccia verso il fuoco) e INIA / ENH / INIC (superfici interne, verticali/orizzontali con faccia verso il fuoco verso l'alto). La sua classificazione è valida per le seguenti condizioni di impiego:
 The product Eurofoam HF is defined as a insulation material - INIA / ENH / INIC (interior surfaces, vertical/horizontal downwards-facing / horizontal upwards-facing). Its classification is valid for the following and use applications:
 - Lotta dei requisiti R1 - basillato su supporto incombustibile
 Requirement set R1 - Glued on non-combustible substrate

3.2. Descrizione / Description:
 Il prodotto Eurofoam HF è completamente descritto nei rapporti di prova in accordo della classificazione elencata in 3.1.
 The product Eurofoam HF is fully described in the test reports in support of the classification listed in 3.1.

4. DICHIARAZIONI / STATEMENTS
 - I risultati di prova contenuti nel presente rapporto di classificazione si riferiscono esclusivamente al campione prova.
 Test results contained in this classification report relate only to the specimen tested.
 - Il presente rapporto di prova non può essere riprodotto parzialmente senza l'autorizzazione del Responsabile di Laboratorio.
 Test report shall not be reproduced except in full without the written approval of the Managing Director.

IMQ

CSI

RAPPORTO DI CLASSIFICAZIONE / CLASSIFICATION REPORT 0753DCREA/13_2
 Data / Date: 05/06/2013

**5. RAPPORTI DI PROVA E RISULTATI DI PROVA IN SUPPORTO DI QUESTA CLASSIFICAZIONE
 TEST REPORTS AND TEST RESULTS IN SUPPORT OF THIS CLASSIFICATION**

5.1. Rapporti di prova / Test reports

| Nome del Laboratorio / Name of laboratory | Nome del Committente / Name of sponsor | Numero di Identificazione del rapporto di prova / Test report ref. No. | Metodo di prova / Test method |
|---|--|--|------------------------------------|
| CSI S.p.A. | UNION FOAM S.p.A. | 0753DCREA/13_1 | ISO 5658-2 - T02 |
| CSI S.p.A. | UNION FOAM S.p.A. | 0004DC/TOX/14_1 | ISO 5659-2 - T10.1, T10.01, T10.03 |

5.2. Risultati di prova / Test results

| Metodo di prova / Test method | Parametro / Parameter | Numero di prove / Number of tests | Risultati, valore medio / Results, mean value | Conformità alla lista dei requisiti / Compliance with requirements set |
|-------------------------------|-----------------------|-----------------------------------|---|--|
| ISO 5658-2 - T02 20 mm | CFE | 3 | 38,16 | R1;HL1;HL2;HL3 |
| ISO 5659-2 - T10.1 20 mm | Dq4 | 3 | 225,6 | R1;HL1;HL2 |
| ISO 5659-2 - T10.2 20 mm | VOF4 | 3 | 774 | R1;HL1 |
| ISO 5659-2 - T10.3 20 mm | CTI ₃₀ | 3 | 0,40 (240s) 0,64 (480s) | R1;HL1;HL2;HL3 |

6. CLASSIFICAZIONE / CLASSIFICATION

6.1. Riferimenti / Reference
 Questa classificazione è stata condotta conformemente alla norma EN 45545-2:2013 per la conformità alla tabella 5, (con requisiti R1, il prodotto deve soddisfare i criteri di classificazione per ogni metodo di prova riportato).
 This classification has been carried out in accordance with EN 45545-2:2013 to meet the requirements in table 5, see requirement R1, the product must fulfil the classification for each test method reported.

6.2. Classificazione / Classification
 Il prodotto Eurofoam HF, installato su supporto non combustibile che consiste in una lastra di acciaio di 0,8 mm di spessore, in riferimento al suo comportamento al fuoco, in accordo alla EN 45545-2:2013 è classificato secondo la lista di requisiti R1, livelli di rischio HL1, HL2 e HL3 e classificate.
 The product Eurofoam HF, glued on non-combustible substrate consisting of a 0,8 mm steel plate, in relation to its reaction to fire behaviour, is classified in EN 45545-2:2013 classified in requirement set R1, hazard levels HL1, HL2 and HL3 as classified.

**Classificazione di reazione al fuoco: R1; HL1
 Reaction to fire classification: R1; HL1**

IMQ

CSI

RAPPORTO DI CLASSIFICAZIONE / CLASSIFICATION REPORT 0753DCREA/13_2
 Data / Date: 05/06/2013

7. LIMITAZIONI / LIMITATIONS

7.1. Avvertimenti / Warning
 Questo documento non rappresenta un'approvazione di tipo ad una certificazione del prodotto.
 This document does not represent type approval or certification of the product.

DATA / Date: 05/06/2013

Resp. Contratti / Contracting Head: **Piero Farnagalli**

A.D. Divisione Certificazione e Testing / Testing and Certification Division CEO: **Rand Gatti**

IMQ

MED 96/98 EC Directive - Requisites and conditions to obtain the conformity marking

Shipbuilding sector - passenger transport

shipbuilding sector

Fire safety

As regards the revision of the fire protection code, IMO (International Maritime Organisation) has updated the FTP Code to IMO RES MSC 307(88) Ed. 2010, completing and describing in greater detail the various test methods.

It came into force from 1st July 2012 and its use became obligatory (with regard to carrying out tests) from 1st July 2013.

Compared to the previous edition of the code, one of the new features introduced regards tests carried out for the new certificates which should be dated within the previous five years. Tests carried out before a five year period can be validated only if released by authorised institutes.

Ten points of the Code have been updated (point 6 has been completely eliminated) and a summary is shown in the table below where parameters relevant to fire behaviour have been labelled with the following sign (▲) and those relevant to fire resistance with the sign (■).

| |
|---|
| 1) Incombustibility test ▲ |
| 2) Smoke and toxicity test (in accordance with ISO 5659-2) ▲ |
| 3) Class A, B and F division test ■ |
| 4) Fire door control systems test ■ |
| 5) Surface flammability tests (according to ISO 5658-2 + heat release rate measurement) ▲ |
| 6) <u>ELIMINATED POINT</u> |
| 7) Vertically supported materials and film ▲ |
| 8) Padded furniture tests ▲ |
| 9) Bed components tests ▲ |
| 10) Fire-restricting material tests ▲ |
| 11) Test for fire resistant partitions for fast embarkation ■ |

The optical density and the concentration of substances present in combustion gases are also measured. The number of items to be tested are now 6 instead of 3, as stipulated by the previous edition of the Code.

The requisites for insulation material have been compared to wall and floor cladding and are regulated by SOLAS 74, by the FTP Code 61 (67) and by the IMO MSC Circular No. 916 (determination of toxic gases, No. 1004-1008 for reference purposes).

Specifically, the FTP Code (Annex 1 Parts 2 and 5) requires carrying out tests from which the methodological conformity is required as shown in the table below:

FLAME SPREAD WITH RADIANT HEAT PANEL METHOD (IMO A 653 (16) FOR USE AS WALL CLADDING (EVALUATION PARAMETERS)

CFC = Critical flow >20 kW/m²

Qsb = Heat of combustion >1,5 MJ/m²

Qt = Total heat <0,7 MJ

Qp = Heat release peak <4,0 kW

Determination of smoke and gas according to ISO 5659-2 (NBS Chamber) with irradiation of 25 kW (with or without flame) and of 50 kW (without flame).

MED 96/98 EC Directive - Requisites and conditions to obtain the conformity marking
Shipbuilding sector - passenger transport

shipbuilding sector

Fire safety

The maximum optical density of smoke (Dm) must not exceed a value of 200 in a period of 4 minutes. As regards gases, the acceptable values (parts per million) are specified in the following table and a comparison is made with the results obtained by the EUROBATEX HF insulation material:

| Acceptable limits | | | EUROBATEX HF values |
|-------------------|------|-----|---------------------|
| -CO | 1450 | ppm | 870 |
| -HCL | 600 | ppm | 16,5 |
| -HF | 600 | ppm | <0,1 |
| -NOx | 350 | ppm | 61,0 |
| -HBr | 600 | ppm | <0,1 |
| -HCN | 140 | ppm | 22,8 |
| -SO2 | 120 | ppm | 22,5 |

For cladding material in the areas near stairs, corridors and escape routes, the Determination of Calorific Value is required if relevant, according to ISO 1716, the maximum reference value being 45MJ/m².

UNION FOAM S.p.A., along with the Management System Certificate according to ISO 9001 and the relevant CE Marking has obtained the MED Mark of Conformity as underlined in the above table and in the following certificates regarding both Module B (EC Certificate of type examination) and Module D (EC quality system certificate for production) in accordance with the Directive.

Quality Management Certificate ISO 9001

DNV-GL

MANAGEMENT SYSTEM CERTIFICATE

Certificate No./Certificate No.: CERT-03587-98-AQ-HIL-SINCERT Data prima emissione/Initial date: 13 febbraio 1998 Validità/Valid: 25 novembre 2015 - 15 settembre 2018

Si certifica che il sistema di gestione di/This is to certify that the management system of

UNION FOAM S.p.A.
Via dell'Industria, 8/11 - 20882 Bellusco (MB) - Italy

È conforme ai requisiti della norma per il Sistema di Gestione Qualità/ has been found to conform to the Quality Management System standard:

UNI EN ISO 9001:2008 (ISO 9001:2008)

Questa certificazione è valida per il seguente campo applicativo:
Progettazione, produzione e commercio di tubi e lastre in elastomero espanso (Settore EA: 14)

This certificate is valid for the following scope:
Design, manufacture and trade of pipes and sheets in elastomeric foam (EA Sector: 14)

Luogo e Data/Place and date: **Vimercate, 28 ottobre 2015**

Per l'Organismo di Certificazione/ For the Certification Body
ACCREDIA
 Vittorio Marangon
 Management Representative

La validità del presente Certificato è subordinata al rispetto delle condizioni contenute nel Contratto di Certificazione/
 Lack of fulfillment of conditions as set out in the Certification Agreement may render this Certificate invalid.
 DNV GL Business Assurance Italia S.r.l. Via Energia Park, 14, 20871 Vimercate (MB), Italy. Tel: 039 68 99 905, www.dnvgl.it/businessassurance

MED 96/98 EC Directive - Requisites and conditions to obtain the conformity marking

Shipbuilding sector - passenger transport

shipbuilding sector

Fire safety

EC certificate of type examination according to the procedures required by Module B (Attachment - Directive 96/98/EC)

CSI **CSI CERT**

Certificato numero / Certificate number: MED/0497/421

CERTIFICATO CE DEL TIPO (MODULO B) EC CERTIFICATE (MODULE B) OF TYPE EXAMINATION

Si certifica che CSI SPA, Organismo Notificato n. 0497, ha effettuato le procedure di approvazione per l'equipaggiamento identificato di seguito che è risultato essere conforme ai requisiti di Protezione antincendio della Direttiva 2014/90/UE e del Regolamento di Esecuzione (UE) 2017/306.

This is to certify that CSI SPA, Notified Body n. 0497, did undertake the relevant type approval procedures for the equipment identified below which was found to be in compliance with the fire protection requirements of Marine Equipment Directive (MED) 2014/90/EU and of the implementing Regulation (EU) 2017/306.

Richiedente/ Applicant: **UNION FOAM S.p.A.**
Via dell'Industria, 11 - 20040 BELLUSCO (MI) - ITALY

Item MED/ MED item: **MED/3.1Bd**

Descrizione/ Description: **Materiali di copertura e rivestimenti per pavimenti a limitata capacità di propagazione della fiamma:**
a) rivestimenti per la sovrastazione di tubature
Surface materials and floor coverings with low flame-spread characteristics;
a) pipe insulation covers

Tipi/ Type: **EUROBATEX HF**

Norme di prova / Testing standards: **IMO Res. MSC.307(88) - (2010 FTP Code) Annex 1 Part 5**

Norme di riferimento / Reference standards: **Reg. II-2/3, Reg. II-2/5, Reg. II-2/6, Reg. II-2/9, IMO Res. MSC.30(63)-1994 HSC Code 7, IMO Res. MSC.97(73)-(2000 HSC Code) 7, IMO MSC/Circ.1120**

L'Allegato A è parte integrante del presente Certificato. Questo certificato è valido se non annullato o revocato, purché le condizioni di cui all'Allegato A siano rispettate e l'equipaggiamento sia mantenuto in servizio in modo soddisfacente. The Annex A forms part of this Certificate. This Certificate remains valid unless cancelled or revoked, provided the conditions in the Annex A are complied with and the equipment remains satisfactory in service.

| | | |
|-------------------------------|---------------------------------|---------------------|
| 12/12/2013 | 06/05/2017 | 13/12/2018 |
| Prima emissione / First issue | Ultima emissione / Latest issue | Scadenza / Expiring |

Reg. P. Farnagalli
S.S. Fabbiani (S.S. Product)

CSI **CSI CERT**

Certificato numero / Certificate number: MED/0497/421

CERTIFICATO CE DEL TIPO (MODULO B) EC CERTIFICATE (MODULE B) OF TYPE EXAMINATION ALLEGATO A/ ANNEX A

Richiedente/ Applicant: **UNION FOAM S.p.A.**
Luogo di produzione/ Place of production: **Via dell'Industria, 11 - 20040 BELLUSCO (MI) - ITALY**

| Descrizione prodotto/ Product description | Dimensione massima senza allegati / Max size without annexes |
|---|--|
| Spessore / Thickness: | 6 mm - 22 mm |
| Densità/ Density: | 32-65 kg/m ³ |

Reporti di prova/ Test reports:
n. 0275/DIC/REA/13 del/issue 27/3/2013 emesso da/ issued by CSI SPA
n. 0268/DIC/REA/13 del/issue 05/10/2015 emesso da/ issued by CSI SPA
n. 0270/DIC/REA/13 del/issue 03/04/2017 emesso da/ issued by CSI SPA

Condizioni generali/ General conditions:
Il Marchio di Conformità può essere affisso all'equipaggiamento tipo approvato sopra descritto e una Dichiarazione di Conformità del Produttore può essere rilasciata solo quando il modulo relativo alla fase di controllo della produzione (D, E o F) previsto dall'allegato B della Direttiva 2014/90/UE è pienamente rispettato e controllato con un accordo scritto di ispezione con un Organismo Notificato.
The Mark of Conformity may only be affixed to the above type approved equipment and a Manufacturer's Declaration of Conformity issued when the production control phase module (D, E or F) of the Annex B of the Directive 2014/90/EU is fully complied with and controlled by a written inspection agreement with a notified body.

| | | |
|-------------------------------|---------------------------------|---------------------|
| 12/12/2013 | 06/05/2017 | 13/12/2018 |
| Prima emissione / First issue | Ultima emissione / Latest issue | Scadenza / Expiring |

Reg. P. Farnagalli
S.S. Fabbiani (S.S. Product)

EC quality system certificate for production, with the required requisites according to the procedure of form D.

CSI **CSI CERT**

Certificato numero / Certificate number: MED/0497/421

CERTIFICATO CE GARANZIA DI QUALITA' DELLA PRODUZIONE (MODULO D) EC QUALITY SYSTEM (MODULE D) CERTIFICATE

Si certifica che CSI SPA, Organismo Notificato n. 0497, ha effettuato le procedure di valutazione della qualità per l'equipaggiamento del fabbricante identificato di seguito che è risultato essere conforme ai requisiti di Protezione antincendio della Direttiva 2014/90/UE sull'equipaggiamento marittimo (MED) e con il tipo descritto nei Certificati CE del Tipo (Modulo B) elencati nell'allegato di questo Certificato.

This is to certify that CSI SPA, Notified Body n. 0497, did undertake the relevant quality assessment procedures for the equipment of the Manufacturer identified below which was found to be in compliance with the fire protection requirements of Marine Equipment Directive (MED) 2014/90/EU and with the type described in the EC Type Examination Certificate (Module B) listed in the Annex to this Certificate.

Fabbricante/ Manufacturer: **UNION FOAM S.p.A.**
Via dell'Industria, 11 - 20040 BELLUSCO (MI) - ITALY

mantere e applicare un sistema qualità in conformità ai requisiti dell'Allegato B, Modulo D, Direttiva sull'equipaggiamento Marittimo.
maintain and apply a quality system in accordance with the requirements of the Maritime Equipment Directive Annex B, Module D.

Scopo/ Issue: **Materiali di copertura e rivestimenti per pavimenti a limitata capacità di propagazione della fiamma:**
a) rivestimenti per la sovrastazione di tubature
Surface materials and floor coverings with low flame-spread characteristics;
a) pipe insulation covers

Item MED/ MED item: **A.1/3.1Bd**

| | | |
|-------------------------------|---------------------------------|---------------------|
| 12/12/2013 | 14/12/2016 | 11/12/2018 |
| Prima emissione / First issue | Ultima emissione / Latest issue | Scadenza / Expiring |

Reg. P. Farnagalli
S.S. Fabbiani (S.S. Product)

CSI **CSI CERT**

Certificato numero / Certificate number: MED/0497/421

CERTIFICATO CE GARANZIA DI QUALITA' DELLA PRODUZIONE (MODULO D) EC QUALITY SYSTEM (MODULE D) CERTIFICATE

| Dati Modulo B/ Module B data | | | |
|--------------------------------|--------------|------------|-------------------|
| n. certificato/ Certificate n. | tipo/ tipo | data/ date | ORG/ org |
| MED/0497/421 | EUROBATEX HF | 12/12/2013 | CSI SPA (NB 0497) |

Questo certificato autorizza il fabbricante o il suo mandatario stabilito nella Comunità in unione con il CERTIFICATO CE DEL TIPO (MODULO B) dell'equipaggiamento elencato nell'Allegato A di apporre il "marchio di conformità" (whse/mark), come da esempio:
This certificate authorizes the manufacturer or his authorized representative established within the Community in conjunction with the EC TYPE EXAMINATION (MODULE B) CERTIFICATE of the equipment listed in the Annex A to affix the "Mark of Conformity" (whse/mark), as below:

0497/yy
yy 0497 number of the notified body
yy last two digits of the year in which the mark is affixed

Questo certificato perde la sua validità se il produttore fa qualsiasi cambiamento o modifica al sistema di qualità approvato, che non siano stati notificati, e concordati con l'Organismo Notificato indicato in questo certificato e/o dopo la scadenza, il ritiro o la revoca del Certificato CE del Tipo (Modulo B).
This certificate loses its validity if the manufacturer makes any changes or modifications to the approved quality system, which have not been notified to, and agreed with the notified body named on this certificate and/or after lapse of time, withdrawal or revocation of the EC Type Examination (Module B) Certificate.

| | | |
|-------------------------------|---------------------------------|---------------------|
| 12/12/2013 | 14/12/2016 | 11/12/2018 |
| Prima emissione / First issue | Ultima emissione / Latest issue | Scadenza / Expiring |

Reg. P. Farnagalli
S.S. Fabbiani (S.S. Product)

MED 96/98 EC Directive - Requisites and conditions to obtain the conformity marking

Shipbuilding sector - passenger transport

Fire safety

shipbuilding sector



CERTIFICATE OF FIRE APPROVAL

This is to certify that

The product detailed below will be accepted for compliance with the applicable Lloyd's Register Rules and Regulations and with the International Convention for the Safety of Life at Sea, (SOLAS), 1974, as amended, for use on ships and offshore installations classed with Lloyd's Register, and for use on ships and offshore installations when authorised by contracting governments to issue the relevant certificates, licences, permits etc.

| | |
|---------------------------|--|
| Manufacturer | Union Foam S.p.A. |
| Address | Via dell'Industria 11 20040 Bellusco (MB) Italy |
| Type | MATERIAL HAVING LOW FLAME SPREAD CHARACTERISTICS & NOT CAPABLE OF PRODUCING EXCESSIVE SMOKE & TOXIC PRODUCTS OF COMBUSTION |
| Description | Fire-Resisting Material - Type "Eurobatex HF" |
| Specified Standard | IMO Res. MSC.307(88) - (2010 FTP Code) Annex 1 Part 5 and Annex 2 |

The attached Design Appraisal Document forms part of this certificate. This certificate remains valid unless cancelled or revoked, provided the conditions in the attached Design Appraisal Document are complied with and the equipment remains satisfactory in service.

| | | | |
|------------------------|----------------|--------------------|---|
| Date of issue | 31 August 2017 | Expiry date | 30 August 2022 |
| Certificate No. | SAS F170204 | Signoff |  |
| Sheet No. | 1 of 2 | Name | J.M. Evans Surveyor to Lloyd's Register EMEA A Member of the Lloyd's Register Group |

Note:

This certificate is not valid for equipment, the design or manufacture of which has been varied or modified from the specimen tested. The manufacturer should notify Lloyd's Register of any modification or changes to the equipment in order to obtain a valid Certificate.

Lloyd's Register (UK) Limited is a limited liability company registered in England and Wales. It is a member of the Lloyd's Register Group of companies, which is a group of companies registered in England and Wales. Lloyd's Register (UK) Limited is a member of the Lloyd's Register Group of companies, which is a group of companies registered in England and Wales. Lloyd's Register (UK) Limited is a member of the Lloyd's Register Group of companies, which is a group of companies registered in England and Wales.



Lloyd's Register EMEA
21 Amhurst Street, London, EC3A 8BP
Telephone 020 7423 2434 Fax 020 7423 2051
Email lra@lr.org

| | |
|--------------------|-------------|
| Page | 2 of 2 |
| Certificate Number | SAS F170204 |
| Issue Number | 1 |

DESIGN APPRAISAL DOCUMENT

Date: 31 August 2017

Classification: SCOUTS/SFS/TA/RE/1W2962074

ATTACHMENT TO CERTIFICATE OF TYPE APPROVAL No. SAS F170204

This Design Appraisal Document forms part of the Certificate.

APPROVAL DOCUMENTATION

CSI S.p.A., Viale Lombardia 20, 20021 Bollate (MI), Fire Test Reports No. 0820/DC/REA/15 dated 09 October 2015 and No. 0270/DC/REA/17 dated 3rd April 2017.

CONDITIONS OF CERTIFICATION

- Restricted Application:** Restricted to cold service pipework / fittings on refrigerated systems listed in SOLAS II-2, Reg.53.1.1 everywhere on-board, or to spaces exempt from this requirement in the same regulation, i.e. cargo spaces, mail rooms, baggage room and refrigerated compartments of service spaces.
- Consisting of: halogen free elastomer foams (thickness items to 32mm, density 55 +/- 5 kg/m³)
- Smoke and toxicity criteria is satisfied by meeting the total heat release (Q) and peak heat release rate (q) as stated in IMO Fire Test Procedures Code, Annex 2, Section 2.2
- Composition of individual components, including any flame retardants, to be maintained in production in accordance with originally tested composition formula.
- Production items are to be manufactured in accordance with a quality control system which shall be maintained to ensure that items are of the same standard as the approved prototype.

PLACE OF PRODUCTION

Union Foam S.p.A.
Via dell'Industria 11
20040 Bellusco (MB)
Italy



Jessica Evans
Service Specialist
Statutory Fire & Safety
Southampton Technical Support Office, Marine & Offshore
Lloyd's Register EMEA

Supplementary Type Approval Terms and Conditions

This certificate and Design Appraisal Document relates to type approval, it certifies that the prototype(s) of the product(s) referred to herein hereafter have been found to meet the applicable design criteria for the use specified herein. It does not mean or imply approval for any other use, nor approval of any products designed or manufactured otherwise than in strict conformity with the said prototype(s).



TYPE APPROVAL CERTIFICATE

No. LAB185117CS-001

This is to certify that the product identified below is in compliance with the regulations herewith specified.

| | |
|--|---|
| Description | Materials with low flame spread characteristic and with low smoke specific optical density and toxicity of the combustion products |
| Type Applicant | Eurobatex HF UNION FOAM SPA VIA DELL'INDUSTRIA 11 20040 Bellusco (MB) ITALY |
| Manufacturer Place of manufacture | UNION FOAM SPA VIA DELL'INDUSTRIA 11 20040 Bellusco (MB) ITALY |
| Reference standards Reference documents | IMO Res. MSC.307(88)-(2010 FTP Code) Chap. II-2 of SOLAS 74 Convention, as amended, RINA Rules for the Testing and Certification of Marine Materials and Equipment |

Issued in Genoa on August 28, 2017. This Certificate is valid until August 27, 2022


RINA Services S.p.A.
Enrico Cappelletti

This certificate consists of this page and 1 enclosure



RINA Services S.p.A.
Via Cavour, 12 - 10128 Genova
Tel +39 010 53911
Fax +39 010 5391100

TYPE APPROVAL CERTIFICATE

No. LAB185117CS-001
Enclosure - Page 1 of 1
Eurobatex HF

Product description

Halogen free elastomeric foams.

- Density (kg/m³): 55 ± 5
- Thickness range (mm): 6 to 32

Field of application

As pipe insulation covers.

On the basis of the value of the total heat release (Q) and on the basis of the value of the peak heat release (q) the material is deemed not generating excessive quantities of smoke nor toxic products in fire according to Annex 2 IMO 2010 FTP Code.

Tests carried out

Tests as per CSI Test Laboratory reports No. 0820/DC/REA/15 dated 9 October 2015 and No. 0270/DC/REA/17 dated 3 April 2017 issued according to IMO 2010 FTP Code Part 5.

General conditions for the approval

- The initial conditions verified by RINA at the time of the approval are to be maintained.
- Any changes to the initial conditions are to be promptly communicated to RINA, which reserves the right to repeat the relevant assessment.
- This certificate will not be valid if the manufacturer makes any changes or modifications to the approved equipment, which have not been notified to, and agreed with RINA.
- This RINA personnel are to be allowed to witness during the performance of activities, upon their request.
- The activities are to be carried out in compliance with the RINA Rules and/or other applicable Rules.
- Should the specified regulations or standards be amended during the validity of this certificate, the product is to be reapproved prior to it being placed on board vessels to which the amended regulations or standards apply.

Genoa 28/08/2017



RINA Services S.p.A.
Via Cavour, 12 - 10128 Genova
Tel +39 010 53911
Fax +39 010 5391100

Having obtained the MED certifications, the official approval documents of the products used for on-board insulation as foreseen by the normative are available on request, especially useful since they were issued by official bodies (RINA e LLOYD) which normally carry out the supervision of the products and their suitability for specific uses. Union Foam is therefore now able to provide customers with all necessary documents required by the Shipbuilding sector.

INORGANIC Substances

Resistant.
 Resistant to limited resistance.
 Limited Resistance.
 Limited resistance to not resistant
 Not resistant.

| INORGANIC substances | Concentration level | Resistance in time | | | | |
|---|---------------------|--------------------|----------------------------------|---------------------|--------------------------------------|----------------|
| | | Resistant | Resistant to limited resistance. | Limited Resistance. | Limited resistance to not resistant. | Not resistant. |
| Salts (aqueous solutions) | | | | | | |
| Ammonium Nitrate | saturated solution | | | | | |
| Ammonium Phosphate | solution 30% | | | | | |
| Ammonium Sulphate | solution 30% | | | | | |
| Potassium Nitrate | 30% or gas | | | | | |
| Rocksalt | melting mixture | | | | | |
| Sodium Carbonate | saturated solution | | | | | |
| Sodium Chloride | saturated solution | | | | | |
| Sodium Nitrate | saturated solution | | | | | |
| Sodium Sulphate | saturated solution | | | | | |
| Zinc Chloride | saturated solution | | | | | |
| Electroplating Solutions of the Metals | | | | | | |
| Sulphur dioxide | gas | | | | | |
| Chlorine | gas and liquid | | | | | |
| Bases | | | | | | |
| Ammonia | 30% or gas | | | | | |
| Calcium Hydrate | saturated solution | | | | | |
| Acids | | | | | | |
| Hydrochloric Acid | 20% | | | | | |
| Hydrochloric Acid | concentrated | | | | | |
| Hydrofluoric Acid | 48% | | | | | |
| Nitric Acid | 20% | | | | | |
| Nitric Acid | concentrated | | | | | |
| Phosphoric Acid | concentrated | | | | | |
| Others/Altro | | | | | | |
| Hydrogen Peroxide | 30% | | | | | |
| Hydrogen Peroxide | 3% | | | | | |
| Hydrogen Sulphide | gas | | | | | |
| Sugared Water | 30% | | | | | |
| Caustic Soda | concentrated | | | | | |

ORGANIC Substances

Resistant.
 Resistant to limited resistance.
 Limited Resistance.
 Limited resistance to not resistant.
 Not resistant.

| ORGANIC substances | Concentration level | Resistance in time | | | | |
|--|---------------------|--------------------|----------------------------------|---------------------|--------------------------------------|----------------|
| | | Resistant. | Resistant to limited resistance. | Limited Resistance. | Limited resistance to not resistant. | Not resistant. |
| Alcohols | | | | | | |
| Ethyl Alcohol | — | | | | | |
| Ethylene Glycol | — | | | | | |
| Glycerine | — | | | | | |
| Methyl Alcohol | — | | | | | |
| Acids | | | | | | |
| Acetic Acid | 20% | | | | | |
| Concentrated Acetic Acid | 99-100% | | | | | |
| Esters | | | | | | |
| Tricresyl Phosphate | — | | | | | |
| Aldehydes, Ketones | | | | | | |
| Acetaldehyde | solution 40% | | | | | |
| Acetone | | | | | | |
| Formalin (water sol. -40% of Formaldehyde) | — | | | | | |
| Ethers | | | | | | |
| Ethyl Ether | | | | | | |
| Saturated Aliphatics Hydrocarbons | | | | | | |
| Hexane | gas or liquid | | | | | |
| Methane | gas | | | | | |
| Aliphatic Halogenated Hydrocarbons | | | | | | |
| Carbon Tetrachloride | — | | | | | |
| Chloroform | — | | | | | |
| Freon 11 (boiling point 74 F) | liquid and gas | | | | | |
| Freon 113 (boiling point 114 F) | liquid and gas | | | | | |
| Trichloroethylene | — | | | | | |
| Aromatic Hydrocarbons | | | | | | |
| Benzene | — | | | | | |
| Hydrocarbon Blends | | | | | | |
| Gas Oil | — | | | | | |
| Hydraulic Oil | — | | | | | |
| Motor Fuel FAM | liquid | | | | | |
| Oils ASTM specifications 1, 2, 3 | — | | | | | |
| Petroleum/Petrol, Crude Petroleum | — | | | | | |
| Animal and Vegetable Oils and Fats | | | | | | |
| Castor Oil | — | | | | | |
| Linseed Oil | — | | | | | |
| Soyabean Oil | | | | | | |
| Others | | | | | | |
| Carbon Disulphide | gas | | | | | |
| Carbon Disulphide | liquid | | | | | |
| Detergents and Surfactants | | | | | | |
| Molasses | | | | | | |

EUROBATEX AT

CHEMICAL RESISTANCE

ORGANIC Substances

Resistant.
 Resistant to limited resistance.
 Limited Resistance.
 Limited resistance to not resistant.
 Not resistant.

| ORGANIC substances | Concentration level | Resistance in time | | | | |
|---|---------------------|--------------------|----------------------------------|---------------------|--------------------------------------|----------------|
| | | Resistant. | Resistant to limited resistance. | Limited Resistance. | Limited resistance to not resistant. | Not resistant. |
| Alcohols | | | | | | |
| Ethyl Glycol, Glycerine | — | | | | | |
| Methanol, Ethanol Propanol, Butanol | — | | | | | |
| Acids | | | | | | |
| Acetic Acid | 50% | | | | | |
| Acetic Anhydride | — | | | | | |
| Chloroacetic and Trichloroacetic Acid | — | | | | | |
| Adipic, Butyric, Caproic, Lactic, Maeic and Oxalic Acid | — | | | | | |
| Formic, Stearic, Plmmitic Oleic and Chlorosulphonic Acid | — | | | | | |
| Amines | | | | | | |
| Ethanolamine Triethanolamine | — | | | | | |
| Trimethylamine Triethylamine, Propylamine | — | | | | | |
| Esters/ | | | | | | |
| Methyl Acetate, Ethyl Acetate Amyl Acetate | — | | | | | |
| Ethyl Acrylate | — | | | | | |
| Diethylphthalate | — | | | | | |
| Tributyl Phosphate, Tricresyl Phosphate | — | | | | | |
| Butyl Stearate | — | | | | | |
| Aldehydes, Ketones | | | | | | |
| Acetaldehyde | — | | | | | |
| Acetone, Methyl Ethyl Ketone | — | | | | | |
| Acrolein | — | | | | | |
| Acrylonitrile | — | | | | | |
| Cyclohexanone | — | | | | | |
| Ethers | | | | | | |
| Diethyl Ether Tetrahydrofuran | — | | | | | |
| Saturated Aliphatics Hydrocarbons | | | | | | |
| Methane, Propane, Hexane, Isooctane, Kerosene | — | | | | | |

EUROBATEX AT

CHEMICAL RESISTANCE

ORGANIC Substances

Resistant.
 Resistant to limited resistance.
 Limited Resistance.
 Limited resistance to not resistant.
 Not resistant.

| ORGANIC substances | Concentration level | Resistance in time | | | | |
|---|---------------------|--------------------|----------------------------------|---------------------|--------------------------------------|----------------|
| | | Resistant. | Resistant to limited resistance. | Limited Resistance. | Limited resistance to not resistant. | Not resistant. |
| Unsaturated Aliphatics Hydrocarbons | | | | | | |
| Ethane, Propene, Butadiene Acetylene | — | | | | | |
| Aliphatic Halogenated Hydrocarbons | | | | | | |
| Methylene Chloride, Ethylene Chloride Chloride | — | | | | | |
| Ethylene Dichloride | — | | | | | |
| Trichloroethylene, Chloroform, Perchloroethylene | — | | | | | |
| Carbon Tetrachloride, Ethylene Bromide, Allyl Chloride | — | | | | | |
| Vinyl Chloride, Freon | — | | | | | |
| Aromatic Hydrocarbons | | | | | | |
| Benzene, Toluene, Xylene Tetralin, Decalin | — | | | | | |
| Aniline, Nitrobenzene | — | | | | | |
| Naphtalene, Styrene, Phenol, Vinylpyridine | — | | | | | |
| Chlorobenzene, Bromobenzene, Benzyl Chloride | — | | | | | |
| Benzaldehyde | — | | | | | |
| Mineral Oils | — | | | | | |
| Animal and Vegetable Oils and Fats | | | | | | |
| Olive Oil, Butter | — | | | | | |
| Coconut Oil, Castor Oil, Soyabean Oil | — | | | | | |



EUROBATEX AT

CHEMICAL RESISTANCE

INORGANIC Substances

Resistant.
 Resistant to limited resistance.
 Limited Resistance.
 Limited resistance to not resistant.
 Not resistant.

| INORGANIC substances | Concentration level | Resistance in time | | | | |
|--|---------------------|--------------------|----------------------------------|---------------------|--------------------------------------|----------------|
| | | Resistant. | Resistant to limited resistance. | Limited Resistance. | Limited resistance to not resistant. | Not resistant. |
| Salts (aqueous solutions) | | | | | | |
| Ammonium, Alkali Metals, Alkaline Earth Metals | – | | | | | |
| Cadmium, Zinc, Aluminium, Iron, Chromium | – | | | | | |
| Antimony, Arsenic, Tin, Silver | – | | | | | |
| Mercury and Uranium Salts | – | | | | | |
| Bases | | | | | | |
| Ammonia, Alkali Metal Hydroxides | – | | | | | |
| Alkali Earth Metal Hydroxides | – | | | | | |
| Acids | | | | | | |
| Hydrochloric Acid | 37% | | | | | |
| Nitric Acid | 30% | | | | | |
| Phosphoric Acid | – | | | | | |
| Sulphuric Acid | 75% | | | | | |
| Sulphurous Acid | – | | | | | |
| Others | | | | | | |
| Copper, Gold, Nickel, Rhodium | – | | | | | |
| Bromine, Iodine | – | | | | | |
| Chlorine | dry | | | | | |
| Chlorine | moist | | | | | |
| Platinum, Silver, Tin, Zinc and Brass | – | | | | | |
| Sulphur Dioxide | dry, moist | | | | | |
| Water, Hot Water, Water Vapour, Sea Water | – | | | | | |



advanced elastomeric thermal and acoustic insulation materials

European Regulation 1907/2006 . REACH

(European law No. 396 of 30/12/2006)

REACH

Substances of Very High Concern (SVHC)

| Substance Name (REACH SVHC) | Name IUPAC | EC No. | CAS No. |
|--|---|------------------------|-------------------------|
| Trirhyl arsenate | Trietil arseniato | 427-700-2 | 15606-95-8 |
| Anthracene | — | 204-371-1 | 120-12-7 |
| 4,4 ³ -Diaminodiphenylmethane (MDA) | — | 202-974-4 | 101-77-9 |
| Dibutyl Phthalate (DBP) | — | 201-557-4 | 84-74-2 |
| Cobalt dichloride | — | 231-589-4 | 7646-79-9 |
| Diarsenic pentaoxide | 1,3 - Dioxodiarsoxane 1,3 - Dioldido | 215-116-9 | 1303-28-2 |
| Diarsenic trioxide | Dioxodiarsoxane | 215-481-4 | 1327-53-3 |
| Sodium dichromate | Bicromato di sodio | 234-190-3 | 10588-01-9 7789-12-0 |
| Musk xylene 5 - tert - butyl - 2,4,6 - trinitro-m-xylene | 1-tert-butil, 5-dimetil, 2, 4, 6 trinitrobenzene | 201-394-4 | 81-15-2 |
| Bis (2-ethylhexyl) phthalate (DEHP) | — | 204-211-0 | 117-81-7 |
| Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified | — | 247-148-4 221-695-9 | 25637-99-4 3194-55-6 |
| Alpha-Hexabromocyclododecane | — | 221-695-9 247-148-4 | 134237-50-6 |
| Beta-Hexabromocyclododecane | — | 221-695-9 247-148-4 | 134237-51-7 |
| Gamma-Hexabromocyclododecane | — | 221-695-9 247-148-4 | 134237-52-7 |
| Alkanes, C10-13, chloro (short chain chlorinated paraffins) | — | 287-476-5 | 85535-84-8 |
| Bis (tributyltin) oxide (TBTO) | Hexa-n-Butyldistannoxan | 200-268-0 | 56-35-9 |
| Lead hydrogen arsenate | Piombo arseniato idrogeno | 232-064-2 | 7784-40-9 |
| Benzyl butylphthalate (BBP) | — | 201-622-7 | 85-68-7 |

Union Foam S.p.A confirms that their products comply with the REACH regulations according to EU Guideline 1907/06. Union Foam S.p.A as a manufacturer of products is in the sense of the REACH Regulation a “downstream user” ; due to this fact the company is not subject to the registration duty under REACH. Union Foam also declares that their suppliers comply with REACH regulations and that the whole range of Union Foam product items is SVHC free.



**Insulation materials.
Our world.
For a better world.**



advanced elastomeric thermal and acoustic insulation materials

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