FIRE PROTECTION LAYER UNDER EXPANDED POLYSTYRENE INSULATION BOARDS, ON PROFILED-METAL ROOF DECKS

FESCO C-DO, EXPANDED POLYSTYRENE, FESCO C, FESCO C-S, RETROFIT, RETROFIT S, FESCO FILLET

- maximum insulation with minimum weight
- contributes to fire safety
- eliminates thermal bridging
- lightens the structure
- strengthens the roof
- quick and easy to install
- resists foot traffic during application
- protects the waterproofing from perforation by mechanical fixings when using lower compression-resistant insulants
DESIGN CONSIDERATIONS

Codes of Practice
The design considerations to be taken into account for a built-up roofing system must be assessed with reference to local Codes of Practice and Building Regulations.

Fire Protection
Fesco B, Fesco C, Fesco B-DO and Fesco C-DO insulation boards are suitable for application on metal decks whatever the use of the building.

The fire rating of a roof containing these boards will depend on the type and nature of the roof deck, the waterproofing system, and/or the surface finish used.

Reference should be made to local Building Regulations:
- Fesco C-S insulation boards (the torch-receivable version of Fesco C insulation board) can be used under the same conditions as Fesco B and Fesco C insulation boards.

The solution proposed in this brochure provides a fire resistant layer between the metal deck and an organic insulant, to protect against the spread of fire from inside a building through the deck and into the insulation/waterproofing complex. This protection is provided by an expanded perlite board Fesco C-DO consisting of:
- offset joints on all four sides of the board, reducing thermal bridging.
- a minimum thickness of offset boards of 40 mm which limits the rise in temperature at the interface between the Fesco C-DO and EPS (expanded polystyrene). For increased protection, 50 mm thick boards can be used.

Note: in all cases in this brochure Fesco B-DO insulation boards (Euroclass B fire classification) can be substituted for Fesco C-DO insulation boards (Euroclass C fire classification).

Roof loading
The solution Fesco C-DO under an EPS insulation board is suitable for all types of roof accessibility e.g. the maintenance of the waterproofing element or rooftop equipment, and will resist the effects of regular foot traffic both during and after the installation of a built-up roof system.

Where heavy foot traffic is expected, an additional protective layer of Fesco C or Fesco C-S in 20 mm thickness, or Retrofit or Retrofit S in 15 mm, can be installed over the EPS just before the application of the waterproofing. Composite boards using either of the above combinations are also suitable.
Typical U-values

All the examples shown below are for bituminous waterproofing systems. The insulants are laid on a vapour control layer, which is laid directly over the deck, under which there is no ceiling. These figures are for guidance only.

The figures below show the overall insulation thickness required for a given U-value, taking $\lambda_0 = 0.050 \text{ W/m.K}$ (Fesco C-DO) in 40 mm thickness, and $\lambda_0 = 0.036 \text{ W/m.K}$ (EPS).

<table>
<thead>
<tr>
<th>U-value W/m2.K</th>
<th>Fesco C-DO + EPS mm</th>
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</thead>
<tbody>
<tr>
<td>0.36</td>
<td>40+60</td>
</tr>
<tr>
<td>0.33</td>
<td>40+70</td>
</tr>
<tr>
<td>0.30</td>
<td>40+80</td>
</tr>
<tr>
<td>0.28</td>
<td>40+90</td>
</tr>
<tr>
<td>0.25</td>
<td>40+105</td>
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</tbody>
</table>

In NEW BUILDING WORK the combination of Fesco C-DO boards with EPS insulation significantly reduces the overall weight of the roof which, in turn, can lead to economies for the supporting structure and the foundations of the building. Furthermore, when used in TOTAL REFURBISHMENT projects, combining the two products is compatible with possible weight restrictions imposed by the existing roof structure.

Where possible, reference should be made to local Building Regulations for minimum recommended U-values for roofs. Below is an example, using a U-value of 0.25 W/m²K to demonstrate the weight of comparable insulation systems:

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Spanning characteristics

Where the boards are fully supported, Fesco C-DO in 40 mm thickness can be used for clear spans up to 110 mm. If the board is not fully supported the table below gives the minimum thickness that should be used.

<table>
<thead>
<tr>
<th>Minimum thickness Fesco C-DO mm</th>
<th>Maximum clear span mm</th>
</tr>
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<tbody>
<tr>
<td>40</td>
<td>90</td>
</tr>
<tr>
<td>50</td>
<td>110</td>
</tr>
<tr>
<td>60</td>
<td>130</td>
</tr>
<tr>
<td>80</td>
<td>210</td>
</tr>
</tbody>
</table>

Roof build-up

**Decking**

Decks should be designed in accordance with the relevant clauses of local Building Regulations. For an aesthetic internal finish, pre-painted galvanised metal decking can be used with pre-painted rivets instead of screws.

**Water vapour control**

The need for, and installation of, a separate vapour control layer in the roof construction should be assessed in accordance with local Building Regulations. Care should be taken to ensure continuity at joints, upstands and roof penetrations.

**Mechanical fixing**

Boards should be fixed using screws complying with Class 1 UEA tc resistance to corrosion, in conjunction with square or circular galvanised steel washers (64 x 64 mm or 70 mm diameter). For perforated metal decks the screws should have a minimum thickness of 6.3 mm. The mechanical fixing of insulation boards in constructions where high relative humidity conditions prevail, i.e. swimming pools, paper mills etc. is not advised.
**Waterproofing**

The roof waterproofing should be applied in accordance with manufacturers’ instructions and the relevant Avis Techniques or Agrément Certificates. **Fesco C** insulation boards are suitable for use with both bitumen-based felts and single-ply non bituminous membranes.

CARE MUST BE TAKEN TO PROTECT THE EPS BOARDS WHEN USING WATERPROOFING WITH TORCH APPLICATION (on the side and end laps for example).

For the main roof area this protection can be ensured:

- either by placing a protective layer between the boards and the first layer of waterproofing,
- or with waterproofing having self-adhesive overlaps in the first layer, or by any other appropriate method.

For detailing:

- with expanded perlite angle fillets - **Fesco Fillet**.

1 / APPLICATION UNDER MECHANICALLY-FASTENED WATERPROOFING

Each board comprising the top layer of insulation is initially fastened to the deck with one centrally-placed fastener. In certain cases the EPS boards will be covered with a separation layer to protect against heat or to avoid direct contact with PVC.

The waterproofing system can be either in two layers, the first being mechanically-fastened and the second torch-applied, or a mechanically-fastened single-ply membrane.

The waterproofing is generally fastened in the overlaps, with a sufficient number of fixings for resistance to wind uplift.

**Alternative:** for heavy foot traffic the EPS board can be covered with either a 20 mm thick **Fesco C** or a 15 mm thick **Retrofit** board; no separation layer is required in this case.

2 / APPLICATION UNDER SELF-ADHESIVE WATERPROOFING

Each EPS board comprising the top layer of insulation is restrained with a minimum of four mechanical fixings, one adjacent to each corner of the board. Other fixings needed to meet wind uplift requirements should be evenly distributed over the boards.

The self-adhesive roof waterproofing should be applied in accordance with manufacturers’ instructions and the relevant Avis Techniques, Agrément Certificates or Approved Technical Document.

**Alternative:** for heavy foot traffic the EPS board can be covered with a 20 mm thick **Fesco C-S** or **Retrofit S**, under torch-applied waterproofing.
Waterproofing

The roof waterproofing should be applied in accordance with manufacturers’ instructions and the relevant Avis Techniques or Agrément Certificates.

**Fesco C** insulation boards are suitable for use with both bitumen-based felts and single-ply non bituminous membranes.

Care must be taken to protect the EPS boards when using waterproofing with torch application (on the side and end laps for example).

For the main roof area this protection can be ensured:
- either by placing a protective layer between the boards and the first layer of waterproofing,
- or with waterproofing having self-adhesive overlaps in the first layer, or by any other appropriate method.

For detailing:
- with expanded perlite angle fillets - *Fesco Fillet*.

**SPECIFICATION CLAUSE**

The thermal insulation will consist of a first layer of expanded perlite, double-offset boards *Fesco C-DO* in … mm thickness with a top layer of expanded polystyrene boards.

The *Fesco C-DO* boards are installed, lightly butted together, with the offset joints placed on the flat part of the profiled metal decking. The EPS boards in … mm thickness are applied break-bonded immediately after the *Fesco C-DO* and fixed to the deck with a centrally-placed fastener. Installation shall be in accordance with the Avis Techniques, Agrément Certificate or Approved Technical Document.

The roof waterproofing should be applied in accordance with manufacturers’ instructions and the relevant Avis Techniques or Agrément Certificates. *Fesco Fillet* angle boards shall be used to protect the EPS boards against heat at the upstands.

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The roof waterproofing should be applied in accordance with manufacturers’ instructions and the relevant Avis Techniques or Agrément Certificates. *Fesco Fillet* angle boards shall be used to protect the EPS boards against heat at the upstands.
**Profiled-metal decking**

The metal decking is adapted to the structure, laid dry, and all upstands, rooflights etc installed before application of the insulation.

**Vapour control layer**

The specified vapour control layer should be installed to the manufacturers’ instructions.

**Example 1: first layer of Fesco C-DO**

The offset joints are cut off on one side of the boards - 1a, 2a, 3a and 1b - using a fine-toothed saw.

The board in the angle is cut in half to allow the break-bonding of subsequent rows.

Rows “a” and “b” are laid one after the other, the arrows indicate the laying pattern to facilitate the interlocking of the boards.

When working on multi-bay buildings, and starting at the bottom of the roof slope, the boards are joined at the ridge by cutting the last row of Fesco C-DO boards, ensuring a tight fit is achieved at the joint.

For multi-bay buildings with low slopes (upto 3%) the Fesco C-DO boards are more easily installed in a continuous manner, i.e. starting at the bottom of the slope and adapting the boards to suit the slope over successive ridges and valleys. If necessary, the boards can be fixed to prevent slipping at the bottom of the slope.

**Insulation boards**

Fesco C-DO insulation boards should be stored clear of the ground on a clean level surface, under cover, to protect them from moisture or mechanical damage. Boards should be installed dry and any boards that have been allowed to get wet should be put to one side to dry out before use. Boards should be laid break-bonded either parallel, or at right angles, to the trough openings and all joints lightly butted. The offset joint is cut off to create a straight edge where the board butts on to the upstands.

The following drawings give examples of installation of the two insulation layers.
Example 2: second layer of EPS and fastening

a) under self-adhesive waterproofing: "X" number of fasteners per board depending on wind uplift conditions

b) under mechanically-fastened waterproofing: 1 centrally-placed fastener per board.

**Roof waterproofing**

The roof waterproofing should be applied in accordance with the manufacturer’s recommendations and relevant Avis Technique or Agrément Certificate.

For mechanically-fastened waterproofing, the wind uplift requirements are provided via their fasteners.

The waterproofing should be applied to the boards as soon as possible after fixing. At the end of each day’s work, or whenever work is interrupted, a night joint must be made to avoid water penetration.

**Other applications**

- Built-up roofing solutions with rigid insulation boards on profiled-metal decks for new-build and refurbishment
- High performance roof insulation boards for waterproofing systems on profiled-metal roof decks
- Transformation of standing-seam cold roofs into waterproofed warm roofs
- Built-up roofing solutions over rigid insulation boards on solid roof decks (concrete, wood, etc.)
- Tapered insulation roofing systems
- Insulated car park decks for light and heavy vehicular traffic
- Thermal insulation under asphalt concrete for roof decks with pedestrian access, car parks for light vehicles, and roof gardens
**Health and Safety**

**Fesco** and **Retrofit** insulation boards are chemically inert and safe to use. A Material Safety Data Sheet for each product is available on request.

**Fire safety**

When tested to EN 13823 *Fesco B-DO* insulation board achieves a reaction to fire classification of Bs1d0, and *Fesco C-DO* insulation boards Cs1d0.

When tested to EN ISO 1716 both *Fesco B-DO* and *Fesco C-DO* insulation boards obtain a Gross Calorific Potential (PCS) of 5.1 MJ/kg.

In the DIN 18234 Standard for testing the effects of internal fire on metal roof decks insulated with EPS, a fire protection layer made of expanded perlite offset board in 30 mm minimum thickness is recommended.

*Fesco C* insulation board is certified by Factory Mutual Research for Class 1 insulated steel deck roofs.

**Resistance to roof traffic**

Expanded perlite insulation boards, with D classification to UEAtc test methods, are highly resistant to compression and point loading.

*Fesco* insulation boards contribute significantly to strengthening the roofing system, limiting the risks of damage to the roofing felts. Rigid roof insulation boards contribute to the service life of the built-up roofing system by limiting the risk of perforation, especially by the unthreading upwards of screws, and the possibility of the felts splitting or tearing at the joints in the insulation layer.

**Environment**

Expanded perlite insulation boards are manufactured from both natural and recycled products, have zero ODP (Ozone Depletion Potential) and are chemically neutral. In recognition of its work for a clean environment, the manufacturing facility in Wissembourg has been awarded the “clean technology” Diploma from the French Ministry of the Environment. For information regarding the EPS boards (recycling, etc...) consult the Manufacturers.

**Standards and Approvals**

*Fesco* insulation boards are manufactured under a quality control system approved to ISO 9002. The high quality of all products is continuously monitored, not only internally, but also through external audits by the different European Agrément Boards that certify the production process.

*Fesco C-DO* and *B-DO* insulation boards meet the requirements of EN 13169 and are CE marked.

All products in the Fesco range of insulating boards are certified under the Acermi thermal conductivity procedures, and the principal applications are covered by current Avis Techniques or Agrément Certificates.

This system is covered under an Approved Technical Document delivered by Qualiconsult, quality control Company.

**Product description**

A technical data sheet for *Fesco C-DO* insulation boards is available, on request.

For further information regarding the technical characteristics of EPS boards, consult the Manufacturers.