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CPD Article

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The Importance of Water Flow Reducing Layer in an Inverted Flat Roof

The Water Flow Reducing Layer is central to the thermal performance of an inverted flat roof, minimising heat loss due to the rainwater cooling effect. When designing an inverted roof it is essential to understand their crucial role and how to properly account for their presence in U-value calculations.

Key Learning outcomes

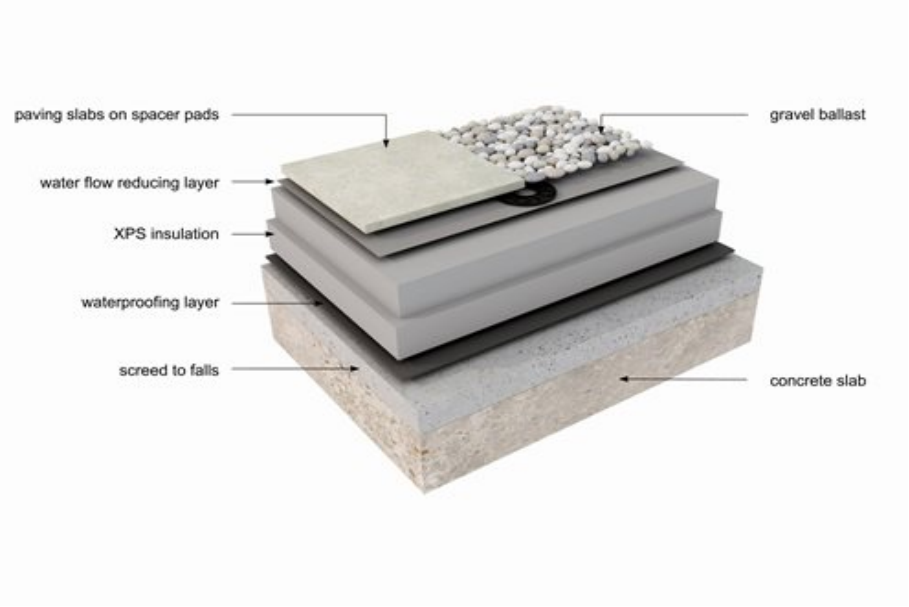
- Core principles of an inverted roof
- Difference between declared lambda and design lambda
- How to calculate the moisture conversion factor
- Value of assurance schemes

1.0 The core principles of an inverted roof

In an inverted flat roof build-up the waterproof roofing membrane is installed directly on top of the structural deck and is protected by the insulation layers without the need for an additional vapour barrier. A water-flow reducing layer (WFRL) is placed on top of the insulation which is then held in place by either paving slabs or gravel ballast. This means the insulation is easy to install and provides convenient access for repairs to the underlying concrete deck.

Inverted roofs offer design advantages given their ease of use for Green Roofs and Blue Roofs, and they comply with the building energy requirement that thermal protection should be unbroken and installed on the outside surface of the building structure. Thermal insulation is an important issue both for winter chill and summer heat, ensuring the efficient reduction of outbound heat flows from a structure when it is being heated and significantly reducing the need for air conditioning.

It is important to consider the suitability of different types of insulation for this type of roof. Extruded polystyrene (XPS) insulation boards are the best solution for inverted roofs due to their unparalleled levels of low water absorption, high compressive strength and exceptional thermal performance.



An inverted roof with paving slabs and gravel ballast.

2.0 Purpose of the WFRL

The WFRL plays an important role in an inverted roof system and must not be confused with the waterproofing membrane that is applied directly to the structural deck. Loose-laid on top of the insulation material, the WFRL reduces the volume of cold rainwater that reaches the roof's waterproofing layer, temporarily reducing the rate of heat loss from the roof due to the rainwater cooling effect.

ETAG 031 (European Technical Approval Guideline for Inverted Roof Kits) defines a WFRL as "a water resistant, diffusion open, UV stable and rot resistant,
Synthetic non-woven membrane" and notes that "the layer also prevents fines and other debris from passing through".

The thermal performance of a roof will be impacted by the lack of a WFRL and the presence of this layer needs to be properly accounted for in U-value calculations to ensure that a structure can meet its intended purpose and meet specified performance goals.

The WFRL minimises heat loss and can therefore reduce the volume of insulation required.

3.0 How does the water flow reducing layer impact U-value calculations?

It is important to understand the difference between declared lambda and design lambda and their intended purposes.

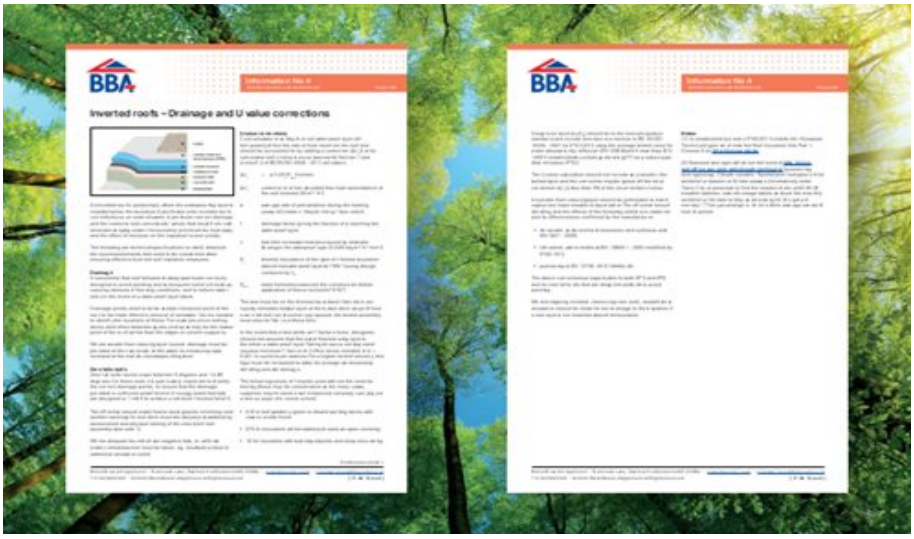
Declared lambda is a measurement of thermal capability and is included in the product's Declaration of Performance (DOP). This takes account of ageing of the material so that the thermal performance is known over the building's lifetime. This set of testing and rules is contained in EN ISO 10456 (Building materials and products — Hygrothermal properties — Tabulated design values and procedures for determining declared and design thermal values) and is part of the CE Marking of the XPS under BS EN 13164 (Thermal insulation products for buildings. Factory made products of extruded polystyrene foam (XPS). Specification). However, once the insulation is used within an inverted roof system, some corrections need to be considered as part of the calculation. ETAG 031 requires that a design lambda must be used for U-value calculations, which includes the moisture conversion factor where the WFRL has a pivotal role.

The moisture conversion factor needs to be accounted for because in an inverted roof the insulation will be partially exposed to the elements. Some rainwater will have contact with both the insulation and the concrete deck thus affecting the thermal performance of the whole system.

ETAG 031 Annex C outlines a test to measure WFRL performance measuring the proportion of water that passes through a build-up. The fraction of water measured is the drainage factor (f) and there is a general acceptance that 2.5% should be used as a minimum factor, even when the test result is 0, as this is not a waterproof layer.

When combined with the standard factor for increased heat loss (x) of 0.040 Wday/m²Kmm this results in a correction factor of fx=0.001 to be applied to the declared lambda to calculate the design lambda. Effectively, 1mW/mK is added to the declared value. A thorough explanation of this calculation process can be found in BBA Bulletin 4 Issue 6 (Inverted roofs – Drainage and U value corrections).

ETAG 031 also details a process to use generic fx values without the need to carry out the WFRL testing, these values being much higher to allow for an extra safety factor, depending on the roof build-up and the edge profile of the insulation used.



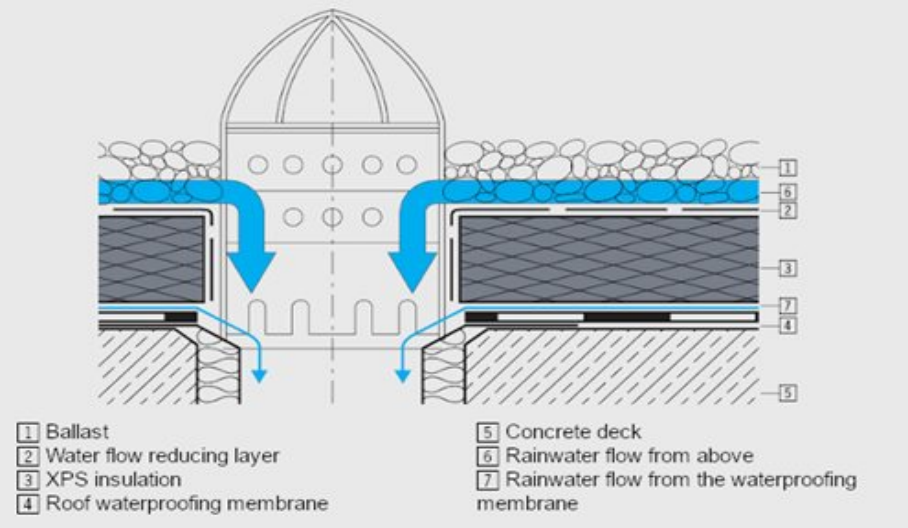
BBA Bulletin 4 Issue 6 provides a thorough explanation of the calculation process

4.0 Ensuring performance is realised

Given the importance of the WFRL to thermal performance on an inverted flat roof, the correct use and installation of the layer is therefore crucial for desktop U-value calculations to be realised and for a building to perform as designed. Guidance for contractors is available from organisations, including the Liquid Roofing and Waterproofing Association (LRWA), to ensure that this critical component is installed as intended. The WRFL will not require maintenance and will last the lifespan of the accompanying insulation.

Once the insulation and the WRFL are placed in the inverted roof, if the finishing used is that covered by the European Commission Decision EC 2000/553/EC, the designation of the roof is Broof(t4) hence complying with Requirement B4 (External Fire spread) of Approved Document B of the Building Regulations.

Third-party assurance schemes such as Agrément Certificates are a vital source of information, providing exacting detail about how a material should be used and installed to achieve the maximum stated performance. Checking for these certificates should not be perceived as a mere tick-box exercise when specifying materials for your project. These Approved Bodies make sure that the latest standards are followed and properly explain best practise for a build-up.



A WFRL must be used and installed correctly for desktop U-value calculations to be realised and for a building to perform as designed