Dow Building Solutions

Insulating inverted flat roofs with XENERGY™ SL: Specification and Installation guide

Design considerations

Introduction

The inverted roof system is ideally suited to flat roofs of heavyweight construction, and offers a durable, attractive roof finish for roofs where maintenance traffic is expected (**Figure 1**).

XENERGY™ SL

XENERGY™ SL products use carbon dioxide as the main blowing agent - the Ozone Depletion Potential (ODP) is zero and the Global Warming Potential (GWP) is less than five.

XENERGY™ SL is designed to give the maximum benefit in inverted roof construction:

- a range of thicknesses allows thermal performance to be matched to project requirements
- shiplapped edges ensure a good interlock between boards, which helps prevent thermal bridging
- rigid boards provide a firm base for the ballast layer.

The XENERGY™ MK system

The rainwater cooling effect (caused by rainwater flowing between the insulation and waterproofing membrane) requires an increase in insulation thickness in order to meet BS EN ISO 6946. However, this increase can be substantially reduced by using the XENERGY™ MK system, which helps to minimise the heat loss due to rainwater cooling and therefore the amount of insulation required.

XENERGY™ MK is waterproof, but at the same time water vapour permeable. It replaces the usual separating layer laid between the insulation and ballast (**Figure 2**). Rainwater is prevented from reaching the waterproofing layer, thereby reducing the rainwater cooling effect.

XENERGY™ MK should be loose-laid over the insulation, at right angles to the slope with 300mm laps running down the slope. This will allow the ballast, 20/40 aggregate, to counter board flotation to be reduced to 50 mm. At upstands and penetrations XENERGY™ MK should be turned up to finish above the surface of the ballast. XENERGY™ MK is a spun bonded polyethylene geotextile with the following properties:

- water vapour permeable
- water resistant
- tear resistant
- UV stable - can be left exposed outdoors for up to four months
- fire - melts and shrinks away from a heat source (unclassifiable as regards Building Regulations)
- temperature - retains flexibility and toughness down to -73°C, melting point is 135°C.

Ballast

Both washed aggregate and dense concrete paving slabs are suitable as ballast for use with XENERGY™ SL insulation.

Aggregate

This gives a good appearance at an economical cost and should be 20-40mm nominal diameter, clean, washed and reasonably free from fines. When boards are overlaid with a suitable separating layer - such as XENERGY™ MK - lapped 300mm, then a 50mm depth of 20/40 aggregate may be sufficient to counter flotation of the insulation. Additional ballast may, however, be needed in those areas subject to wind uplift, such as exposed perimeters and corners.

Aggregate should be replaced by paving slabs:

- to form walkways where regular foot traffic is expected
- where the kerb at the roof edge is too shallow to retain the aggregate
- at perimeters, where calculations indicate aggregate will provide insufficient resistance to wind uplift or will be affected by wind scour - see BRE Digest 311.

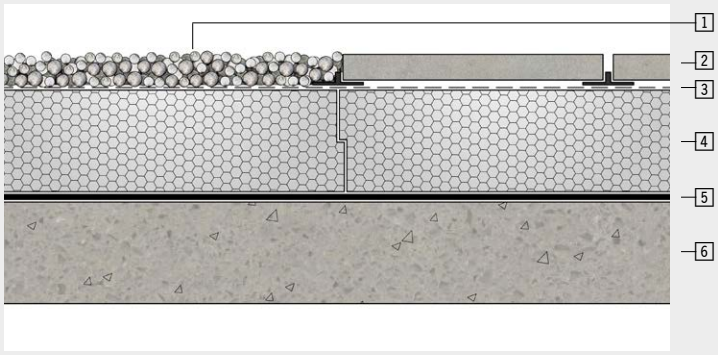
Pavers

Pressed concrete pavers 600mm x 600mm and 50mm thick should be raised off the insulation on spacers to allow drainage and to avoid rocking.

Edge details

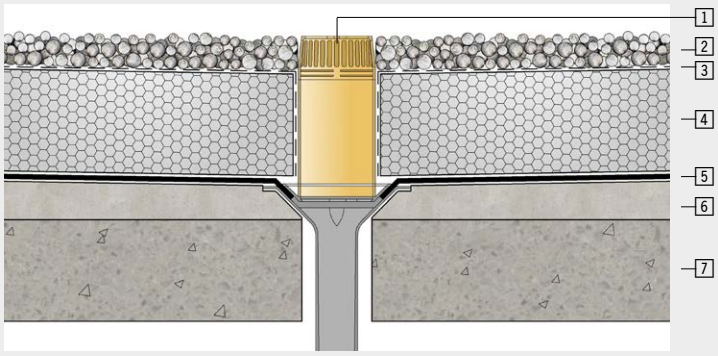
Upstands at parapets and abutments should be protected by either XENERGY™ LG boards set vertically or XENERGY™ SL boards set vertically and covered with an apron flashing (**Figure 3**). Extending the insulation in this way affords a consistent level of protection and helps to avoid thermal bridging. Apron flashings should be carried to at least 150mm above the surface of the ballast.

Kerbs, including those at verges and rooflights, should be high enough to contain the insulation and the ballast. XENERGY™ SL boards should be fitted tight against kerbs.



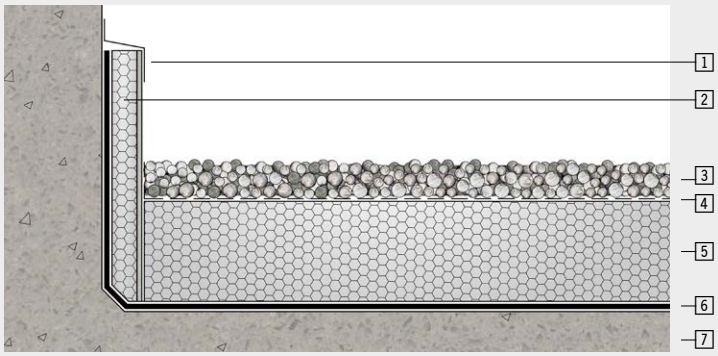
1 ballast
2 paving slabs on spacer pads
3 XENERGY™ MK
4 XENERGY™ SL
5 waterproof layer
6 concrete slab

Figure 1: Ballasted inverted roof



1 rainwater outlet
2 ballast
3 XENERGY™ MK
4 XENERGY™ SL
5 waterproof layer
6 screed to falls
7 concrete slab

Figure 2 XENERGY™ MinK system in the inverted roof



1 apron flashing
2 XENERGY™ LG
3 ballast
4 XENERGY™ MK
5 XENERGY™ SL
6 waterproof layer
7 concrete slab

Figure 3: Lightweight inverted roof - detail at upstand

Drains and gutters

Outlet gratings may be raised on spacer rings to reduce the risk of blockage: cut a hole in the XENERGY™ SL boards to accommodate the outlets (**Figure 2**).
A paving slab on spacer pads may be used above a flat grating (**Figure 4**).

Where possible, line internal gutters with XENERGY™ SL to prevent thermal bridging - the gutter may be spanned by paving slabs on spacer pads (Figure 5).

Where the roof drains to an edge gutter terminate aggregate ballast with a row of paving slabs on suitable supports (**Figure 6**) and protect the edge of the XENERGY™ SL boards with a cover flashing.

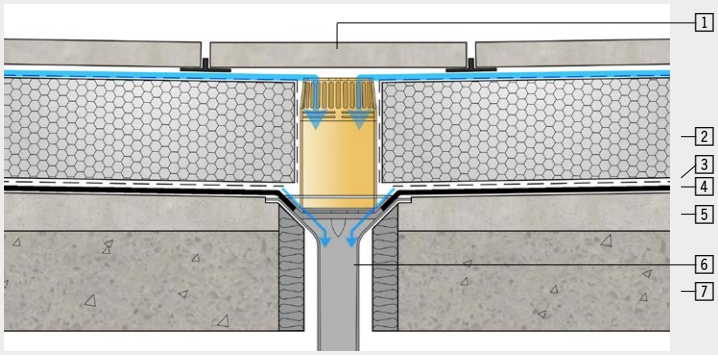
Roof falls and drainage

Good drainage is vital to the long-term performance of a flat roof. As with any building element, when designing a flat roof, it is good design practice to follow and adopt relevant design guidance.
The most referred to guidance is that of BS 6229:2003 – flat roofs with continuously supported coverings which recommends an appropriate fall be accommodated within the roof design, including inverted flat roofs.

It is also vital that the roof is adequately drained to prevent ponding. The location, size and number of rainwater outlets should be designed in accordance with BS EN 12056-3:2000. The roof deck should also be without deflections or depressions in which water may pond.
To perform effectively, XENERGY™ SL boards should not be totally or permanently submerged in water during the product's lifetime on a roof.

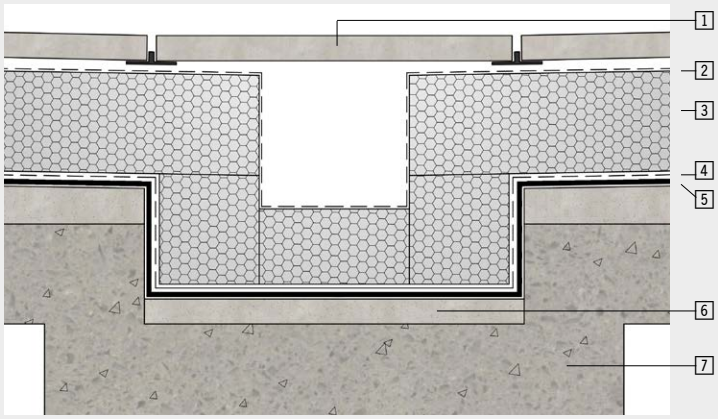
If the roof is regarded as 'zero pitch', then particular attention must be given to the provision of roof drainage to prevent ponding, as outlined in the BBA Information Bulletin No 4. The location, number and size of the drainage outlets need to be designed to facilitate acceptable removal of rainwater (and water from other precipitation) to avoid the thermal insulation boards within the inverted roof construction being either totally or permanently immersed in water.
If significant areas of ponding as a result of back falls are identified, an appropriate design strategy must be adopted to ensure their removal prior to the insulation being installed. Specify rainwater outlets which will accept run-off from both the top of the insulation and the surface of the waterproofing.

Further guidance and information can be found in ETAG 031, Guideline for European Technical Approval of Inverted Roof Insulation Kits Part 1.



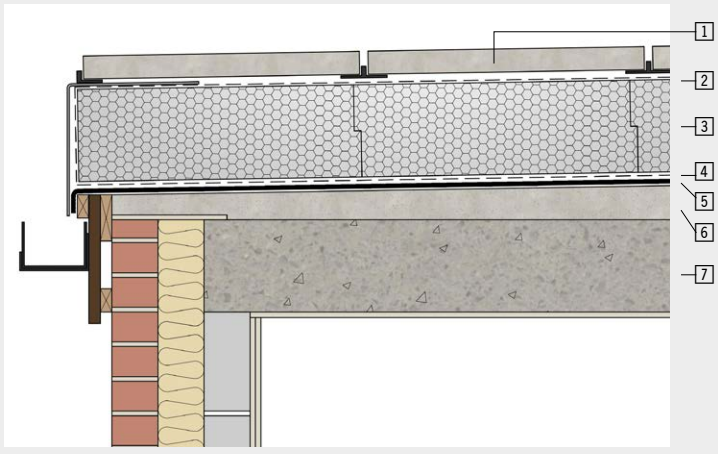
1. paving slabs on spacer pads
2. XENERGY™ SL
3. separating layer (if required)
4. waterproof layer
5. screed to falls
6. roof outlet
7. concrete slab

Figure 4 Ballasted inverted roof - outlet protected by paving slabs



1. paving slabs on spacer pads
2. XENERGY™ MK or a suitable separating layer
3. XENERGY™ SL
4. separating layer (if required)
5. waterproof layer
6. screed to falls
7. concrete slab

Figure 5 Ballasted inverted roof - insulation over internal gutter



1. paving slab on spacer pads
2. XENERGY™ MK or a suitable separating layer
3. XENERGY™ SL
4. separating layer (if required)
5. waterproof layer
6. screed
7. concrete slab

Figure 6 Ballasted inverted roof - detail at eaves

Installation methods

Installation sequence

1 Inspect the roof to ensure it is clean. Plan the installation sequence and the layout of XENERGY™ SL boards.
2 Lay the separating layer (if required) over the waterproof layer; lap all edges by 200-300mm, at perimeters and penetrations turn up above the installed thickness of the insulation.
3 Lay XENERGY™ SL insulation boards in brick bond pattern with shiplap edges pushed together firmly (**Figure 7**).
4 Insulate upstands with XENERGY™ LG boards (**Figure 3**).
5 Fit XENERGY™ SL boards neatly around penetrations (**Figure 8**). Cut boards with a sharp knife or fine toothed saw.
6 Lay XENERGY™ MK or suitable separating layer with 300mm laps at right angles to the slope.
Arrange laps to run down the slope (**Figure 9**).
At upstands and penetrations turn up the filter layer so it finishes above the surface of the ballast.
7 Lay paving slabs on supports around roof perimeters and penetrations as required.
8 Lay the ballast layer progressively. Work on an advancing front away from the point of access so all ballast material is carried across a protected waterproof layer (**Figure 10**).

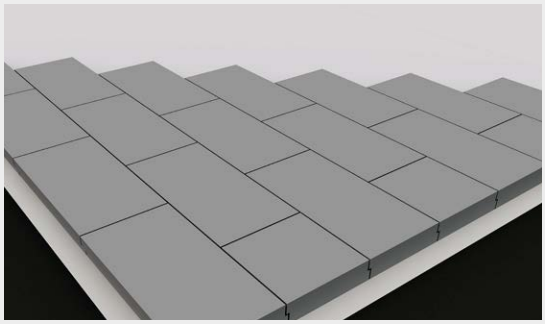


Figure 7

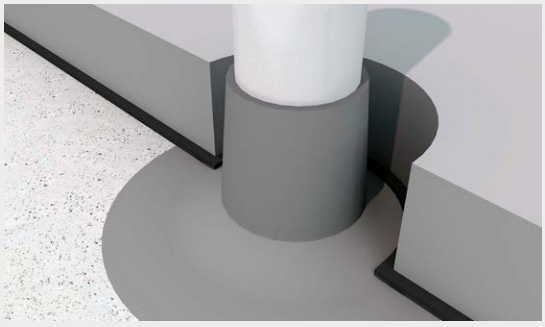


Figure 8

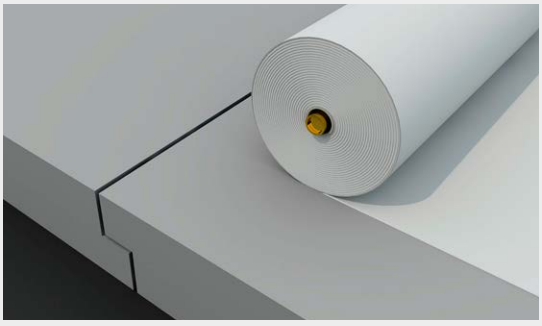


Figure 9

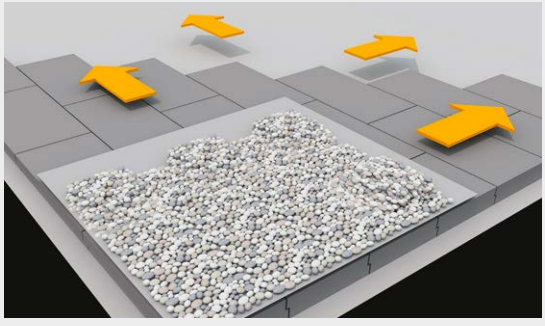


Figure 10

Key points

- careful setting out before installation begins will
- minimise cutting and wastage
- take care not to over-stress any area of the roof while distributing the ballast
- use scaffold boards when barrowing materials over XENERGY™ SL boards.

Specification

J21 Mastic asphalt roofing 120/125
J41 Reinforced bitumen membrane roof coverings
J42 Single layer polymeric roof coverings
440 Extruded polystyrene (XPS) inverted roof insulation
810 Inverted roof insulation
820/840 Ballast layers

XENERGY™ SL

Thicknesses: 50, 80, 100, 120, 140, 160, 180, 200, 205 mm
Board size: 1250 x 600 mm, 2500 x 600 mm (for 200 and 205 mm)
Edge profile: shiplap
Design loading: 130kN/m^2
Fire Classification:
Reaction to fire: BS EN 13164 Euroclass E
Working temperature range: -50°C to +75°C.

Advice guide:

- do not lay insulation until roof is clear of other subtrades
- clean off all dirt and debris from base
- lay separation layer as required
- set out to minimise cutting and avoid small cut pieces at perimeters and penetrations
- loose lay boards, tightly butted and to brick pattern, cut cleanly to fit closely around projections, upstands, rainwater outlets, etc
- on completion of laying ensure boards are in good condition, with no springing, flexing or rocking
- secure boards against wind uplift as soon as practicable
- lay XENERGY™ MK or suitable separating layer.

Recommendations

XENERGY™ products contain a flame retardant additive to inhibit accidental ignition from a small fire source. XENERGY™ is however, combustible and if exposed to an intensive fire may burn rapidly.

During shipment, storage, installation and use XENERGY™ products should not be exposed to flames or other ignition sources.
Fire classification is based on small scale tests, which may not reflect the reaction of the products in its end use state under actual fire conditions. XENERGY™ products should, when installed, be adequately protected from direct exposure to fire.

Recommendations about the methods, use of materials and construction details are given as a service to designers and contractors. These are based on the experience of Dow with the use of XENERGY™ products. Any drawings offered by Dow are meant only to illustrate various possible applications and should not be taken as a basis for design.
Since Dow is a materials supplier and exercises no control over the installation of XENERGY™ products, no responsibility is accepted for such drawings and recommendations.

In particular, no responsibility is accepted by Dow for the systems in which XENERGY™ products are used or the method of application by which they are installed. The legal obligations of Dow in respect of any sale of XENERGY™ products shall be determined solely by the terms of the respective sales contract.

Visit **www.dowxenergy.co.uk** for further information on XENERGY™ SL insulation products as well as adhesives and sealants from Dow Building Solutions. For technical enquiries email FKLTECH@dow.com.

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