

Introduction



A water flow reducing layer (WFRL) is a loose-laid membrane installed over inverted warm roof insulation. Whilst not a primary waterproofing layer, its function is to act as the principal water collecting surface for rainwater dispersal and to reduce the flow of rainwater infiltrating the insulation layer.

The follow-on benefits are to lessen the rainwater cooling effect in thermal transmittance calculations (allowing target U-values to be met using thinner insulation solutions) and reducing the risk of insulation floatation.

The WFRL also allows the diffusion of any moisture vapour that would otherwise build up within the inverted warm roof insulation and stops fines reaching the waterproofing level.

This guidance note has been produced by a specialist Working Group (WG) convened by the LRWA Technical Committee. The WG consisted of technical experts from the waterproofing, insulation and blue roofing industry.

The performance of a WFRL should be independently tested to ETAG 031, with the result incorporated into third-party* verification of the inverted warm roof solution.

Updates in BS 6229:2025 have led to this revision of this guidance note to help installers achieve best practice.

*Throughout this document third party verification refers to certificates that are issued by accredited certification bodies who operate under ISO/IEC 17065 in the UK and EU.

2. Roof System Design and Construction

To ensure correct performance from a WFRL, the complete inverted warm roof system should be correctly designed, specified and constructed.

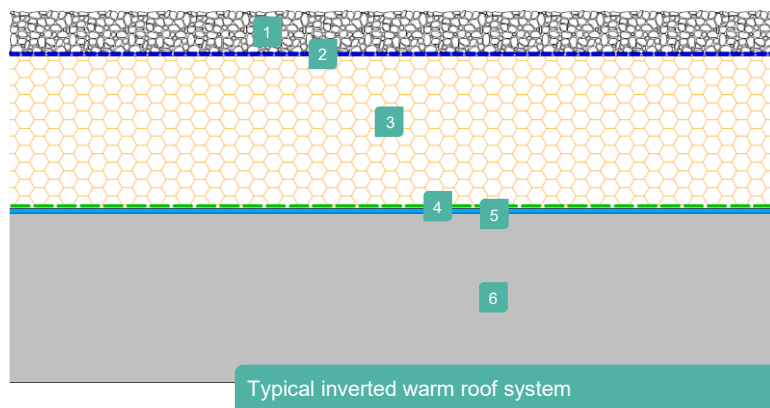
Roof deck

The roof deck - including, cross falls, lateral falls and gutter falls - should achieve drainage falls as described in BS 6229:2025.

Where an inverted warm roof solution is certified by a third party as suitable for use on 'zero falls' for inverted warm roofs or "absolute zero falls" for inverted warm blue roofs, the guidance in BS 6229:2025 is clear that back falls are not acceptable and where found should be corrected by the roof slab/deck installer.

A detailed structural analysis should be used to prove the roof deck as designed will not suffer from negative falls when works are complete. An as-built survey of the structure carried out before handover to the roofing contractor will identify any areas of concern and should be relayed back to the principal designer/structural engineer for confirmation of compliance with the design.

Back falls/negative falls should be avoided on all roof types. Negative falls are likely to result in ponding water on a roof. Specific to inverted warm roof design is the concern that the long-term presence of excess water may flow under the laps of the WFRL. A flow of water below the WFRL would potentially increase the short-term real-world thermal transmittance of the roof.



1. Indicative ballast
2. Water flow reducing layer (WFRL)
3. Inverted warm roof insulation
4. Protection or separation layer (optional)
5. Waterproofing
6. Structural deck

Waterproofing

Install the inverted warm roof waterproofing system in accordance with the manufacturer's instructions and third-party certification, relevant British Standards codes of practice, and LRWA Guidance Notes and documentation.

Thermal insulation

As per ETAG 031, thermal insulation on an inverted warm roof should be extruded polystyrene (XPS) or expanded polystyrene (EPS), manufactured to EN 13164 or EN 13163 respectively.

When proposing an alternative insulation, such as Inverted Vacuum Insulated Panels and cellular glass, to that prescribed in the ETAG, the principal designer should satisfy themselves that the alternative insulation is suitable for the application.

Loose lay the rigid insulation boards in accordance with the manufacturer's instructions and third-party certification (e.g. BBA or KIWA certificate).

WFRL

ETAG 031 describes typical properties of a water flow reducing layer. Synthetic non-woven membranes supplied as a WFRL should be water resistant, diffusion open, UV stable and rot resistant.

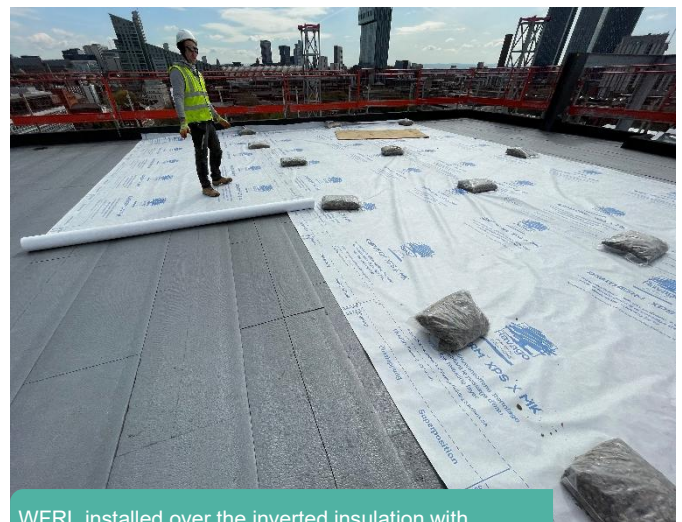
Water flow reducing layers are usually tested with a specific thermal insulation, using a test method detailed in ETAG 031. The insulation and WFRL are typically named together in the third-party certificate and should be installed together in accordance with the manufacturer's instructions.

The contractor should include checks of the WFRL throughout installation to ensure compliance with the manufacturer's instructions as part of their quality control procedures. The waterproofing system holder should ensure the system has been installed to meet the terms of their guarantee. Examples of good practice for WFRL installation are included in the appendices to this Guidance Note.

3. General Installation for Inverted Warm Roofs

As both the insulation and the water flow reducing layer are loose-laid, install only as much of the system as can be permanently or temporarily ballasted at the time to protect from the effects of wind uplift in accordance with the manufacturer's instructions. To avoid potentially damaging both the WFRL and the inverted roof insulation boards, suitable protection may be required beneath the ballast to protect from the effects of foot traffic.

The ballast should prevent any movement of the WFRL, especially at the joints, to ensure the correct laps are maintained during installation. If temporary ballast is used, the laps and joints of the WFRL should be rechecked before any permanent ballast or roof finishes are installed. Where ballast or roof finishes are to be installed by others, a documented handover should be carried out and recorded as part of the quality assurance process. The ballast or roof finish installer should be made aware of this document and good WFRL installation practices.



WFRL installed over the inverted insulation with temporary ballast

Lay the WFRL over the roof insulation, at right angles to any designed drainage fall of the roof, starting at the bottom of the slope. Minimise the formation of laps and ensure that they are formed as much as possible so that water flows towards outlets, over the laps rather than into the laps.

All side and end overlaps should be a minimum of 300 mm. Where 300 mm laps cannot be achieved, for example at penetration, abutment or outlet details, laps should be sealed to hold the laps in place until the ballast is fully installed.

Turn up the membrane at upstands and penetrations so it finishes at or just below the finished roof surface. At penetrations an additional piece of WFRL may be required to ensure continuity of the WFRL.

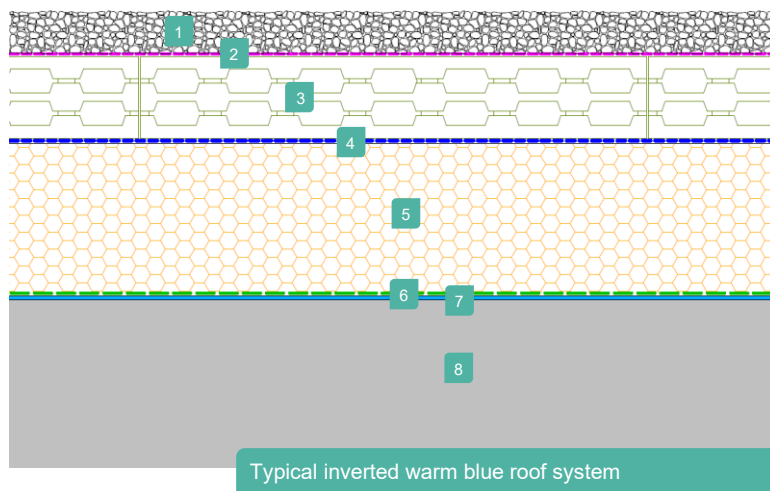
In addition to correctly designed drainage falls, the roof may be designed with dual-level drainage, at both the WFRL level and the waterproofing level. Inverted roof insulation should be cut tight to the shape of the rainwater outlet. An additional piece of WFRL should be turned down at drainage locations to allow water to flow to outlets.

Correct installation of the WFRL should be maintained during any roof maintenance and repair works. If the WFRL is removed for any reason, it should be replaced in accordance with manufacturer's instructions and this guidance document to ensure the roof continues to achieve its designed thermal performance.

Appendix A provides example treatment of typical inverted warm roof details; suitable proprietary products may also be used in accordance with the system supplier's instructions.

4. Guidance Specific to Inverted Blue Roofs

A blue roof system temporarily holds rainwater on a roof, and attenuates its flow away from the roof, to avoid overwhelming storm drainage. They are an increasingly common feature of Sustainable Drainage Systems (SuDS). A blue roof system will function as a normal gravity drainage path off the roof for most of the year, apart from during the key design storm events. It will then actively slow the rainwater's discharge rate off the roof, as part of the wider site SuDS strategy.



1. Indicative ballast
2. Filter layer
3. Blue roof rainwater attenuation layer
4. Water flow reducing layer (WFRL)
5. Inverted warm roof insulation
6. Protection or separation layer (optional)
7. Waterproofing
8. Structural deck

BS 6229:2025 introduces the concept of “absolute zero falls” for inverted warm blue roofs. To achieve an even distribution of water across the whole roof and aid attenuation calculations, blue roofs function best when they are designed at absolute zero falls with no back falls.

For inverted warm blue roofs, BS 6229:2025 states that WFRL laps should be sealed in the field area, at upstands, flow restricting device and penetrations.

LRWA guidance is that all laps in the field area and details that are within the attenuation zone (as a minimum) should be sealed. There are alternative ways to create inverted warm blue roofs, but due consideration should be given to mitigate the risk of floatation and the temporary effects on thermal performance, see CIRIA Report C817. There is no requirement to seal the WFRL to the rainwater outlet at the primary waterproofing level, unless specifically required by the blue roof manufacturer.

At all details, the WFRL should be installed a minimum of 50mm above the top of the blue roof attenuation level (H-Max) and terminate at or just below the finished roof surface.

Inspection and maintenance of the blue roof should be carried out in accordance with the blue roof manufacturer’s programme, and the terms of the blue roof warranty.

Beyond that, the installation of the blue roof solution is the remit of its manufacturer and/or their registered contractor. Detailing is critical to the success of a blue roof installation, and systems are not intended to be installed or inspected by anyone without the appropriate training.

Appendix B provides example treatments of typical details in inverted warm blue roofs. The appendix shows suggested methods of sealing laps, but other methods and suitable proprietary products may also be specified by the system supplier.

5. Roof Finishes

The installation of ballast or roof finishes should be in accordance with the system manufacturer’s specification to provide the necessary resistance to wind uplift and floatation, and to achieve the required fire performance.

Green roof and blue roof solutions are designed and specified by specialists and are subject to their own guidance which is itself changing as they become more common. More information is available in the Green Roof Organisation (GRO) Code of Practice.

6. References

BS 6229:2025 Flat roofs with continuously supported flexible waterproof coverings. Code of practice

BS EN 13164: 2012+A1:2015 Thermal insulation products for buildings. Factory made extruded polystyrene foam (XPS) products. Specification

BS EN 13163:2012+A2:2016 Thermal insulation products for buildings. Factory made expanded polystyrene foam (EPS) products. Specification

ETAG 031 Guideline for European Technical Approval of Inverted Roof Insulation Kits

CIRIA Publication C817:2024 Blue roofs. A guide to implementation

Appendix A

Inverted Warm Roof Application - Example Treatment of Details

Joints and laps in the WFRL should be a minimum 300mm. The method of installation of the WFRL and sealing joints less than 300 mm should be in accordance with the system supplier's instructions – for example, taping of joints with self-adhesive tape, but this may not be the only option. When cutting the WFRL, use a sharp knife or strong scissors.

Internal Corner



Step 1

Installation should be subject to the system supplier's instructions.

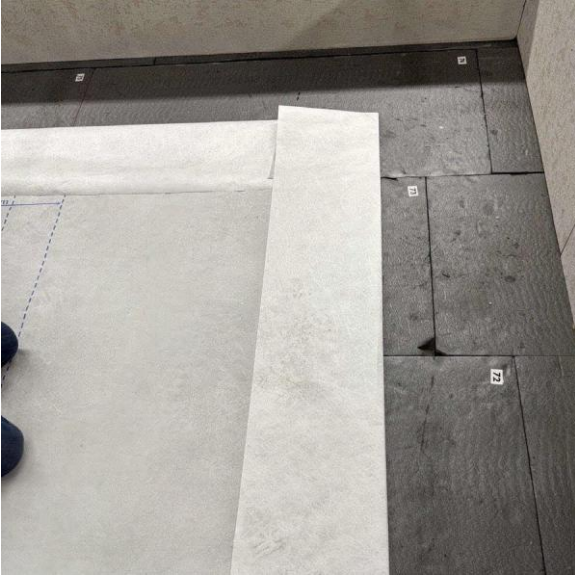
Using any printed lines as a guide, fold one edge of the WFRL to the required upstand height (typically 150mm or level with top of the finishes)

Guidance for the Installation of Water Flow Reducing Layers in Inverted Roofs

GN 14-2026

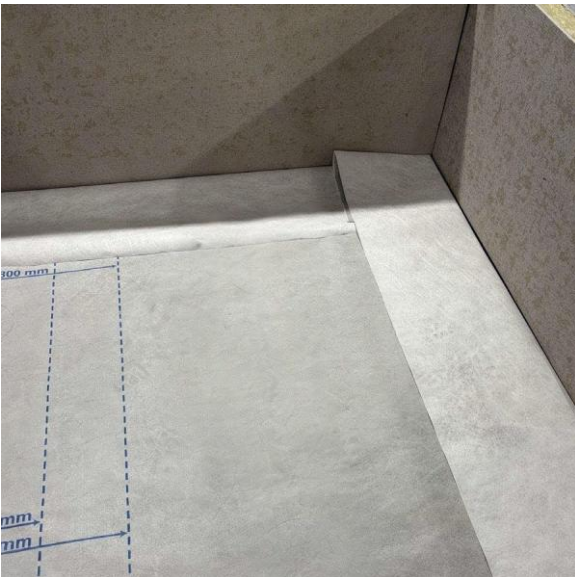
V: 2.2 – 05/05/2026

Internal Corner (Continued)



Step 2

Fold the other edge of the WFRL in a similar fashion.



Step 3

Butt the folded corner to edges of roof.

Internal Corner (Continued)



Step 4

Lift both upstands, forming diagonal crease at corner.



Step 5

Hold the corner in place until temporary ballast can be installed.

Guidance for the Installation of Water Flow Reducing Layers in Inverted Roofs

GN 14-2026

V: 2.2 – 05/05/2026

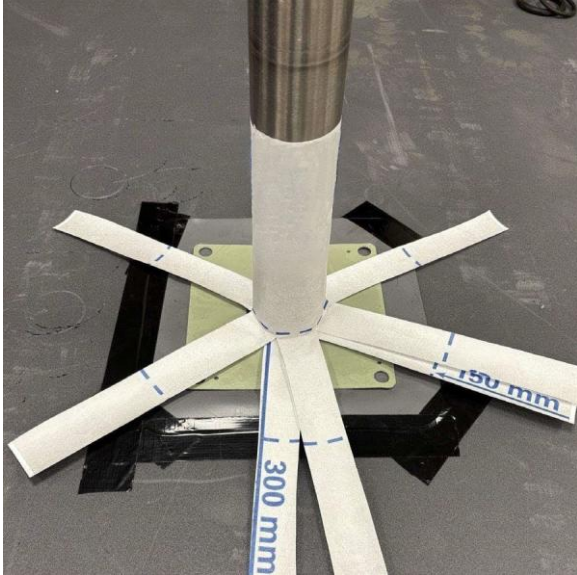
Internal Corner (Continued)



Step 6

Ballast to hold in place until the full ballast system is installed.

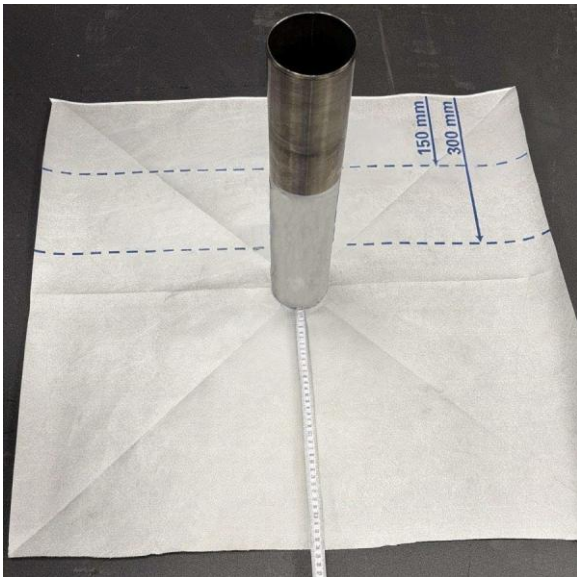
Pipe Penetration



Step 1

Installation should be subject to the system supplier's instructions.

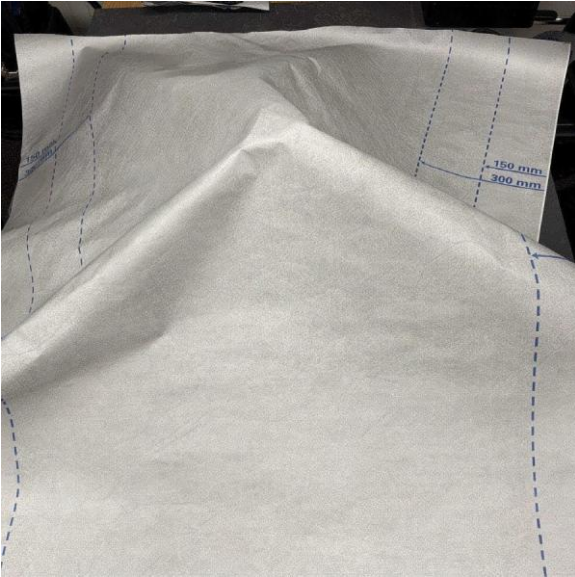
Form the upstand collar to the required height (typically 150mm or level with the top of finishes) with 300mm splayed fringe tabs.



Step 2

Form a square of WFRL measuring 600mm larger than the penetration. Using scissors or a sharp knife, make a cut slightly smaller than penetration and push down over the penetration making sure that the collar is not displaced.

Pipe Penetration (Continued)



Step 3

Drape the field area WFRL over the pipe penetration in the correct position.



Step 4

Make a cut slightly smaller than the penetration with scissors or a sharp knife.

Guidance for the Installation of Water Flow Reducing Layers in Inverted Roofs

GN 14-2026

V: 2.2 – 05/05/2026

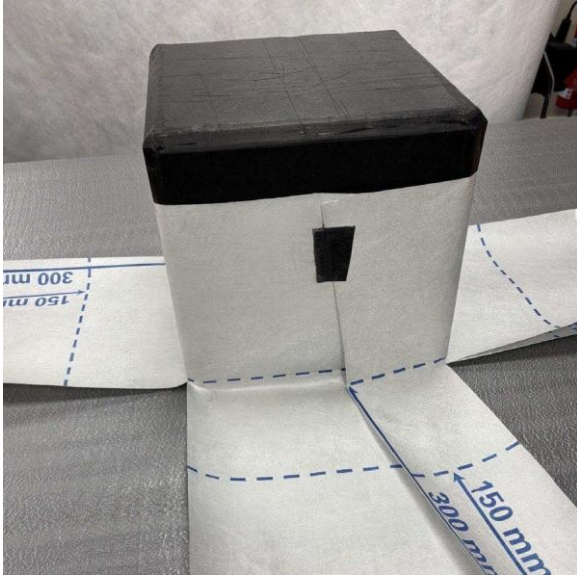
Pipe Penetration (Continued)



Step 5

Press the field area WFRL down over the penetration and into position making sure not to displace the collar.

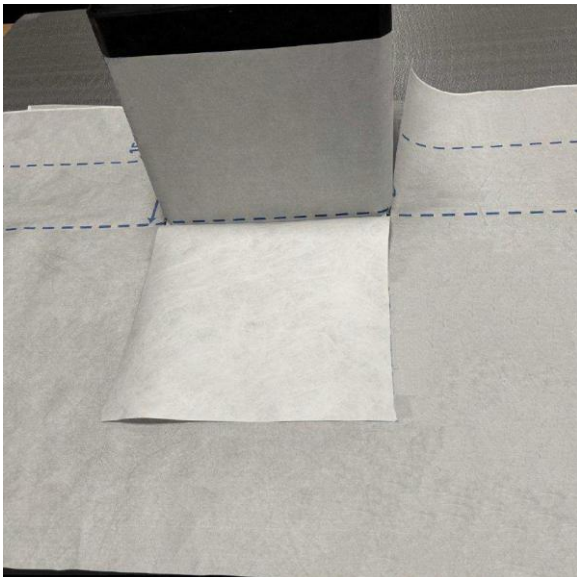
Plinth Penetration



Step 1

Installation should be subject to the system supplier's instructions.

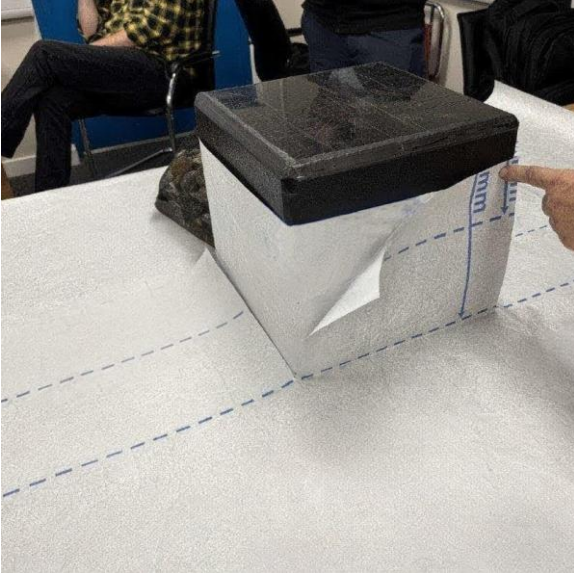
Form an upstand to the required height (typically 150mm or level with the top of finishes) with 300mm splayed fringe tabs. Hold in place



Step 2

Cut the field WFRL slightly undersize to the penetration from one edge of WFRL and fold the section back. Repeat for the other side of the penetration.

Plinth Penetration (Continued)



Step 3

Fold the cut section of the field WFRL up the plinth and hold in place.



Step 4

Install ballast to keep overlaps in place until the full ballast system is installed.

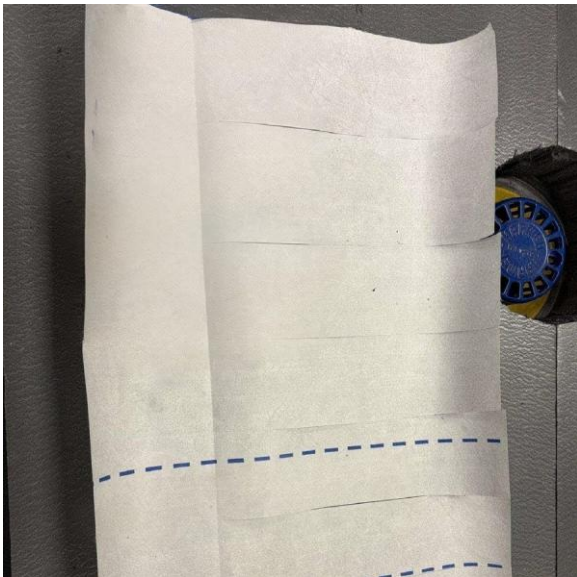
Rainwater Outlet (RWO)



Step 1

Installation should be subject to the system supplier's instructions.

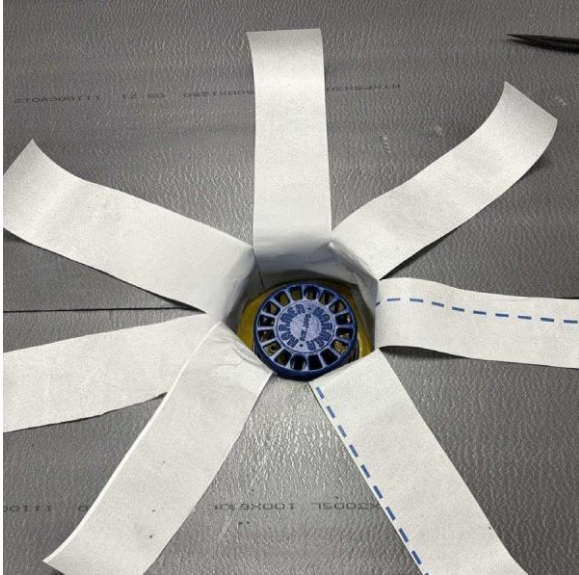
Insulation should be neatly cut tight to the shape of the RWO (do NOT square cut for circular RWOs).



Step 2

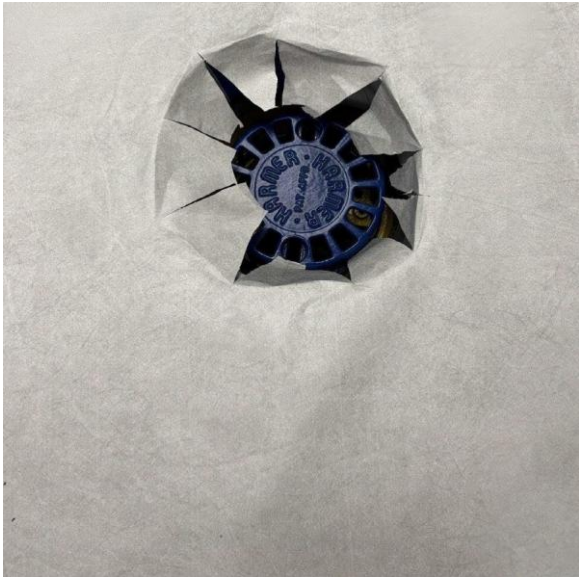
Create a downstand piece to the depth of insulation with 300mm long tabs to keep in place. The length of the piece should be sufficient to fully go around the perimeter of the cut out.

Rainwater Outlet (Continued)



Step 3

Dress into the RWO cut out and splay out the tabs as evenly as possible.



Step 4

The field area WFRL can then be installed over the area and star cut aligning cuts with centre of lower layer tabs.

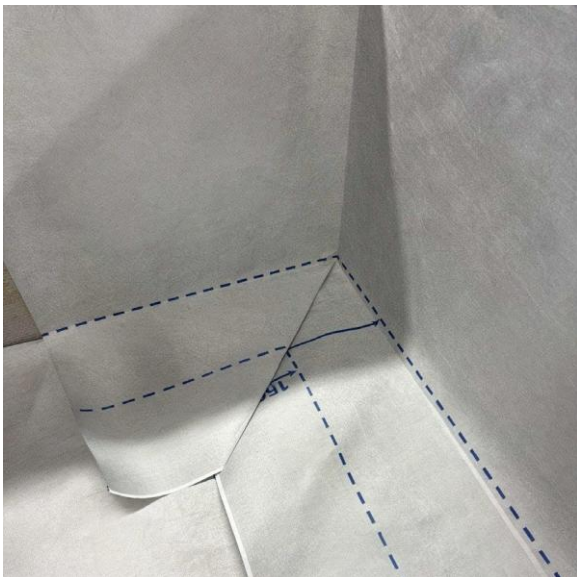
Appendix B

Inverted Warm Blue Roof Application - Example Treatment of Details

The detailing of inverted warm blue roof elements, where the WFRL acts as the attenuating layer, should follow the general inverted warm roof guidelines outlined in Appendix A, while also permitting joint sealing as described in BS 6229:2025.

The method of sealing joints should be in accordance with the system supplier's instructions – the following examples show taping of joints using conventional self-adhesive tape and a conformable self-adhesive tape. The conformable self-adhesive tape is used to seal over joints that may have a slight fishmouth. Alternative methods and materials may be specified by the system supplier.

Internal Corner



Step 1

Installation should be subject to the system supplier's instructions.

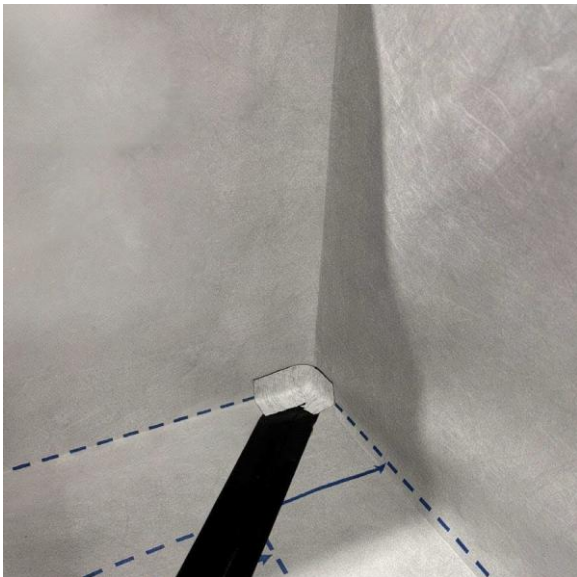
Install the field area WFRL into the corner.
Form the upstand WFRL by folding and forming a diagonal crease

Internal Corner (Continued)



Step 2

Use self-adhesive tape to seal along the diagonal.



Step 3

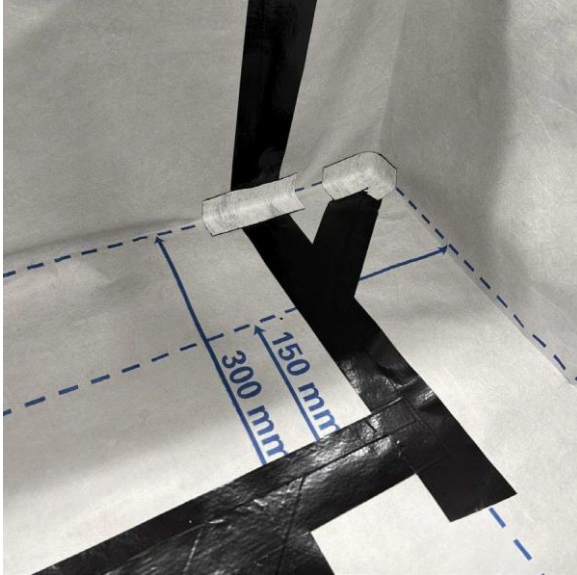
Use a suitable conformable tape to seal into the vertex of the corner. A seam roller and penny roller can be used to apply suitable pressure.

Guidance for the Installation of Water Flow Reducing Layers in Inverted Roofs

GN 14-2026

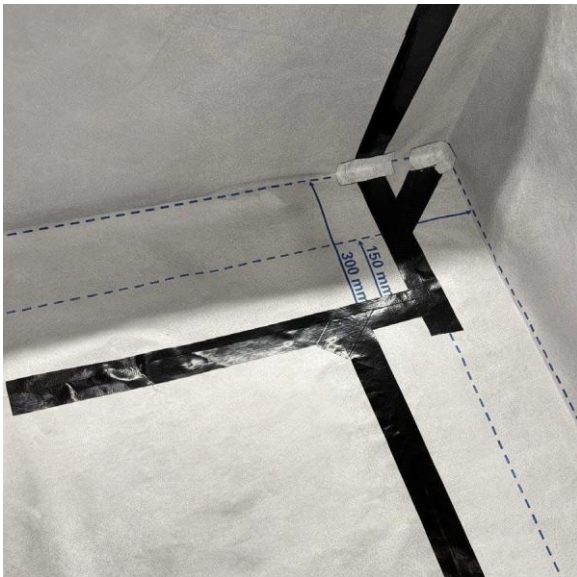
V: 2.2 – 05/05/2026

Internal Corner (Continued)



Step 4

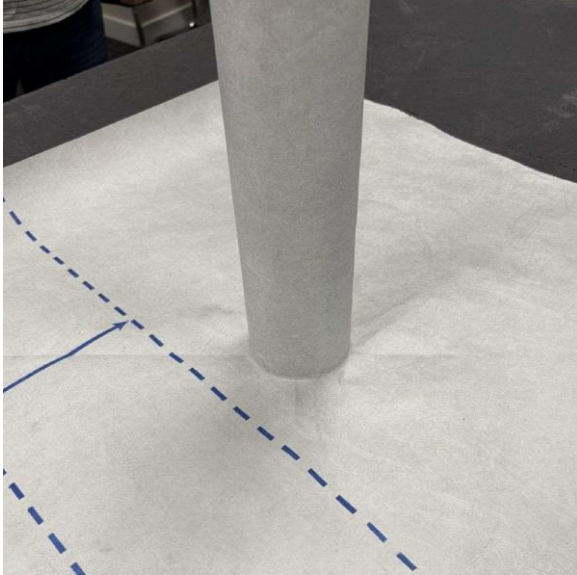
Lap the adjacent upstand WFRL and seal along all the lap edges with self-adhesive tape. Use a suitable conformable tape to seal any possible fish mouths in the angle.



Step 5

Once the corner has been sealed, continue to seal all the laps.

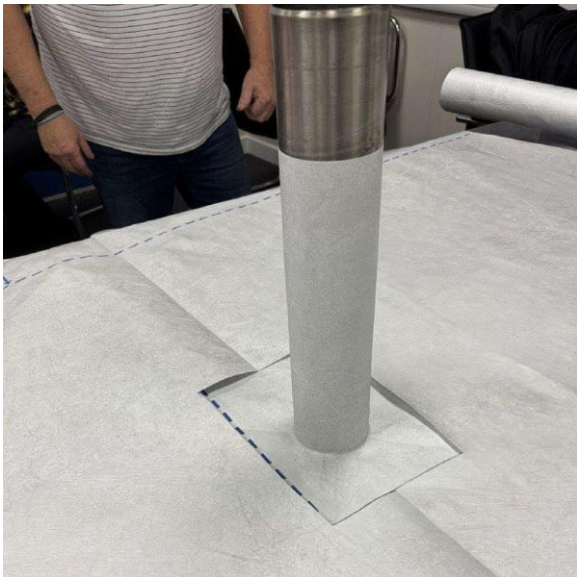
Pipe Penetration



Step 1

Installation should be subject to the system supplier's instructions.

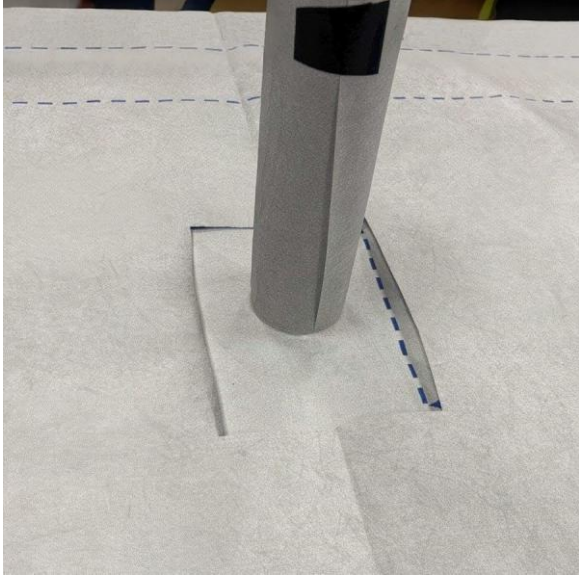
Form a collar for the pipe as per the standard inverted warm roof detail.



Step 2

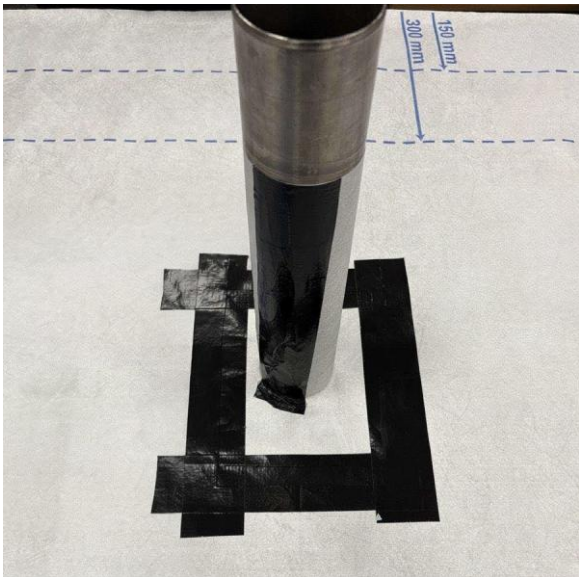
Cut the field WFRL to a neat edge around the penetration.

Pipe Penetration (Continued)



Step 3

Use self-adhesive tape to temporarily hold the collar lap in place.



Step 4

Seal all the laps with self-adhesive tape.

Pipe Penetration (Continued)



Step 5

Use a suitable conformable tape in the angle to seal around the base of the pipe collar.

Cut the tape to length so that a suitable lap will be formed. Carefully cut the release film along the tape, making sure not to cut into the tape itself.

Remove the release film on the horizontal as the tape is formed around the penetration.

Use a seam roller or penny roller to ensure a good seal.



Step 6

Remove the release film from the vertical section and bond the tape into place.

Guidance for the Installation of Water Flow Reducing Layers in Inverted Roofs

GN 14-2026

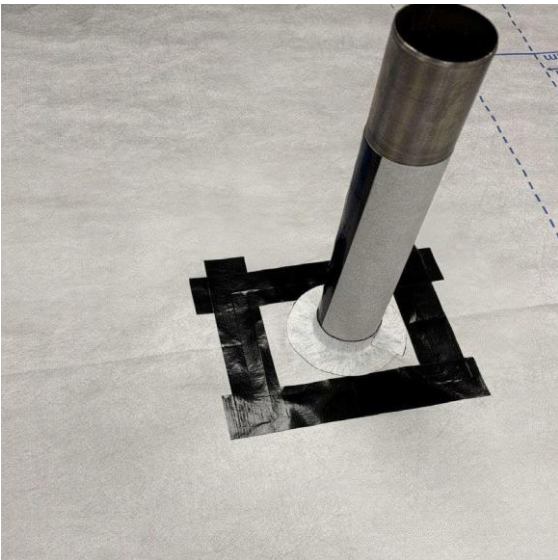
V: 2.2 – 05/05/2026

Pipe Penetration (Continued)

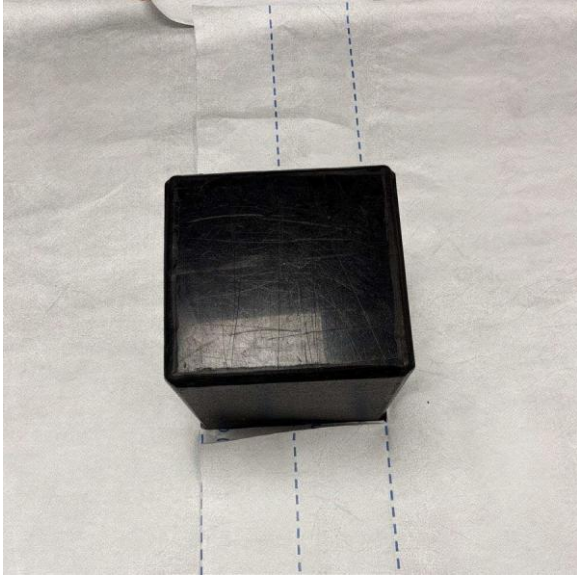


Step 7

Use a seam roller and penny roller to ensure a good seal.



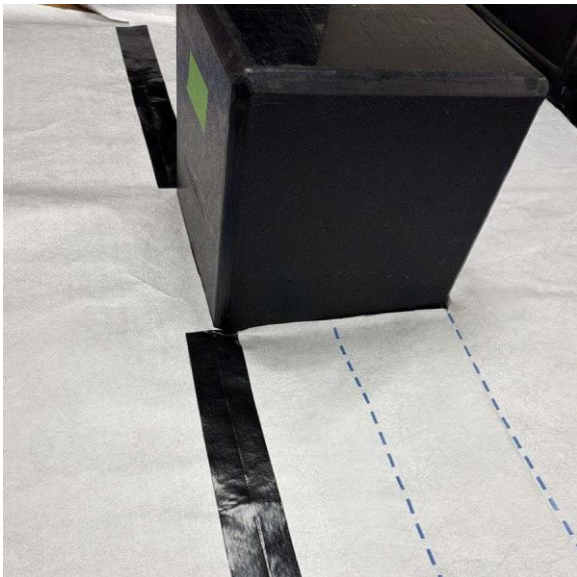
Plinth Penetration



Step 1

Installation should be subject to the system supplier's instructions.

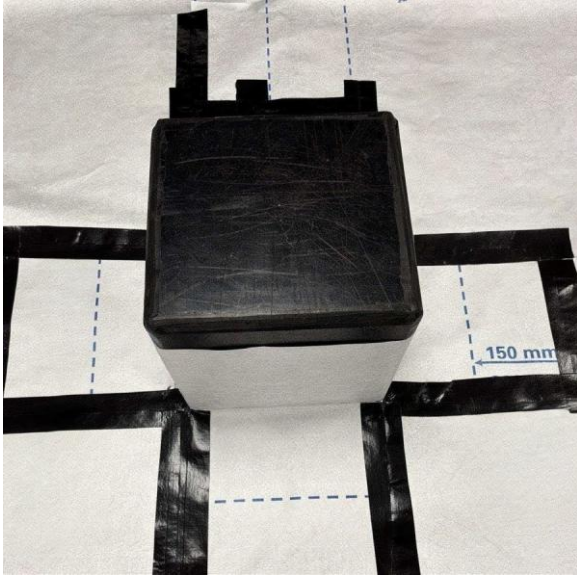
Cut the field area WFRL neatly to the size of the plinth.



Step 2

Use self-adhesive tape to seal along the lap joints.

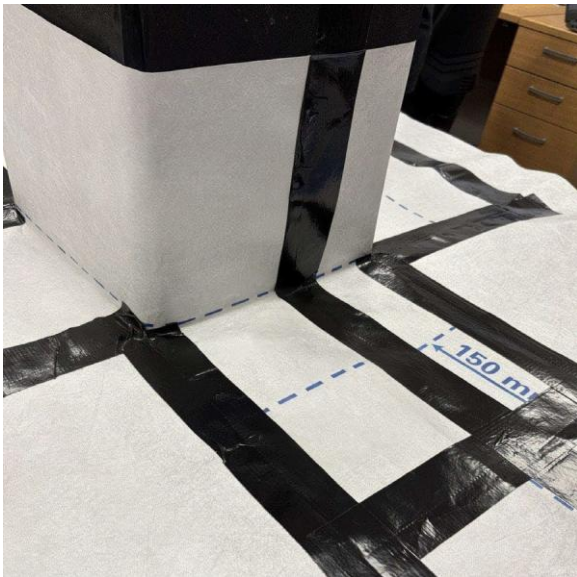
Plinth Penetration (Continued)



Step 3

Form a collar to the upstand to the required height (typically 150mm or level with the top of finishes) with 300mm splayed fringe tabs to wrap around the penetration. Hold in place with tape if required.

Seal all the tab edges with self-adhesive tape.



Step 4

Seal the lap in the upstand WFRL with self-adhesive tape.

Plinth Penetration (Continued)



Step 5

Use a suitable conformable tape in the angle to seal the corners.

Carefully cut the release film along the centre of the tape making sure not to cut into the tape itself. Form around the corner and remove the release film on the horizontal section as the tape is placed into position.



Step 6

Use a seam roller and penny roller to apply pressure to the horizontal section to ensure a good seal.

Plinth Penetration (Continued)



Step 7

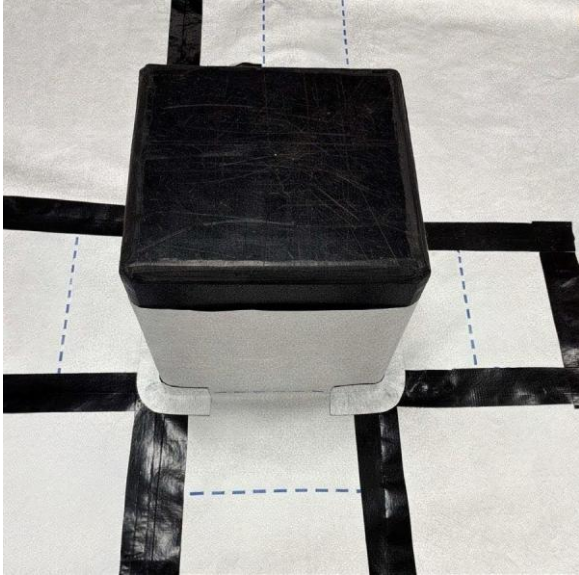
Carefully remove the release film from the vertical section and press the tape firmly into position.



Step 8

A seam roller and penny roller can be used to apply suitable pressure.

Plinth Penetration (Continued)



Step 9

Repeat on all four corners.



Step 10

Use a suitable conformable tape to seal any possible fish mouths in the angle where the lap in the collar is formed.

Guidance for the Installation of Water Flow Reducing Layers in Inverted Roofs

GN 14-2026

V: 2.2 – 05/05/2026



Blue Roof Outlet

The WFRL should be installed with sealed laps at the flow control device in accordance with BS 6229:2025.

Outlets and flow control devices for inverted warm blue roofs vary by supplier and the exact method of sealing should be in accordance with the supplier's instructions.

Published by Liquid Roofing & Waterproofing Association
Roofing House, 31 Worship Street, London EC2A 2DY

www.lrwa.org.uk

General Enquiries:
T +44 (0)333 987 4581
E info@lrwa.org.uk

LRWA and any contributors believe that the guidance and information contained in this document is correct at the time of publication. All parties must rely on their own knowledge and judgement when making use of it.

This document is not exhaustive. Users should verify products, practices and constructions against various functional standards and discuss project details with relevant authorities.

Neither LRWA nor any contributor assumes any liability to anyone for any loss or damage caused by any error or omission in this document, whether such error or omission is the result of negligence or any other cause. Where reference is made to legislation, it is not to be considered as legal advice.

All liability is disclaimed.