

Product Data Sheet

HYTHERM® CG (Cellular Glass) INVERTED

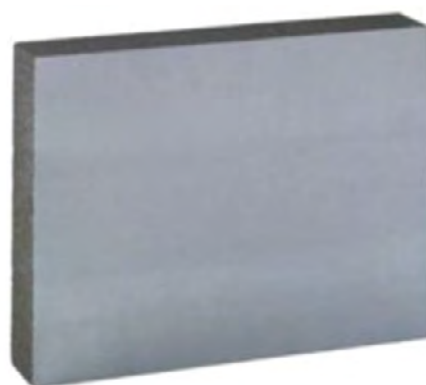
Non-combustible, high performance insulation for inverted roof constructions

Hytherm CG Inverted insulation is a robust, non-combustible insulation material that can play a crucial role in the fire safety of a building as well as providing long-lasting thermal performance in an inverted roof waterproofing system.

Hytherm CG Inverted is a natural mineral based insulation material with a content of minimum 60% specially graded recycled glass. It has a pre-applied inorganic coating on the upper surface. Both the core material and the coating meet the most stringent European A1 fire classification and therefore are incombustible. Hytherm CG Inverted insulation does not combust, support fire, produce fumes or present a fire risk within the building structure.

Hytherm CG Inverted is a closed cell insulation product and is impervious to water, moisture and air. Any water or moisture within the inverted roof construction will not reduce the thermal performance of this insulation.

The inherent characteristics of this robust material ensure that Hytherm CG Inverted insulation provides secure, long-lasting performance without degradation together with design flexibility on the most aesthetically and technically demanding of projects.



Key benefits

- Non-combustible to classification EN 13501-1 A1. No propagation of flames in the event of fire (chimney effect) in ventilation space.
- High compressive strength due to cell structure. Long-term compressive loads can be applied without movement or deformation.
- Waterproof due to hermetically sealed closed cell glass structure. Does not absorb water or swell.
- Vapour and gas resistant; provides constant thermal performance for the lifetime of a building.
- Dimensionally stable.
- Resistant to freeze-thaw
- Resistant to acids and organic solvents; not damaged by aggressive environments.
- Rot- and vermin-proof due to being inorganic; no risk of nesting or seed germination.
- User-friendly; easy to cut with simple tools and to install.
- Ecological; contains recycled glass and can be safely recycled after use.
- Environmental credentials:
 - Inert and non-toxic
 - Manufactured to ISO 14001
 - GWP (Global Warming Potential) = <1.5; ODP (Ozone Depletion Potential) = zero

Performance

Hytherm CG Inverted has a hermetically sealed, closed glass cell structure. It is non-toxic, does not combust or support fire, produce fumes or contribute to fire spread. Its structure also prevents water penetration or tracking by capillary action.

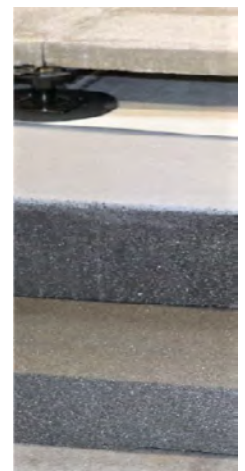
Hytherm CG Inverted is available in a range of thicknesses to meet Building Regulations or project specific U-value requirements.

Use

Hytherm CG Inverted insulation is designed for use in an inverted roof system on a continuous concrete slab on flat roofs, podium decks, terraces, balconies with ballast, paving or tiled walking surfaces. It is ideal as part of a waterproofing design for heavy traffic roofs due to it having one of the highest compressive strengths, including at edges, of any insulating material.

This inverted roof system typically comprises a base layer and top layer, with the top layer always being Hytherm CG Inverted and should be installed on buildings where the internal temperature is always 5°C or more.

Hytherm CG Inverted is loose laid on top of the roof waterproofing system and then weighted down with paving slabs on supports or gravel ballast. The product must be used in conjunction with Axter's water flow reducing layer (WFRL), a drainage/water control layer between the insulation and the ballast layer or under the pedestals for the paving tiles. This minimises rainwater flow beneath the insulation and reduces the rainwater cooling effect; this is taken into account in U-value calculations.



Green Roofs

Hytherm CG Inverted can be incorporated into an extensive or intensive living roof. Depending on structural conditions it is suitable for use on concrete roof slab. It is resistant to the increased amount of vapour and moisture on roofs with planted areas and because it is inorganic, it is highly resistant to all forms of infestation and vermin. The closed glass cells do not store moisture and provide an effective shield against root penetration. There is no risk of fertilizer damaging the insulation as it is resistant to chemicals.

Environment and Ecology

Hytherm CG Inverted is manufactured from minimum specially graded recycled glass (>60%), including scrap vehicle glass and off-cuts from the glazing sector, and natural raw materials (sand, dolomite, lime). It is an inert and non-toxic material and at the end of a building's life the Hytherm CG Inverted insulation can be safely incorporated into hardcore or landscaping.

The glass cell structure of the material is naturally produced and is inorganic and free from ozone-depleting propellants, flame retardants or binders. It is without VOC or other volatile substances. Mutagenic or carcinogenic chemicals are not used during production.

HYTHERM CG INVERTED – Standard Thicknesses & Characteristics

Length x width (mm)	600 x 450				
Average thickness (mm)	100	120	140	160	200
Units per pallet	48	40	32	28	24
m ²	12.96	10.80	8.64	7.56	6.48

HYTHERM CG INVERTED – Typical U-values on concrete slab *

P=3 – f.x-0.001 **	Inverted roof design		
U Value	Hytherm CG base layer (mm)	Hytherm CG Inverted top layer (mm)	Typical overall insulation (mm)
0.33	0	120	120
0.28	0	140	140
0.25	0	160	160
0.21	0	200	200
0.20	60	140	200
0.18	70	140	210
0.15	90	160	250
0.13	100	200	300
0.10	160	200	360

P=8 – f.x-0.001 **	Inverted roof design		
U Value	Hytherm CG Base Layer (mm)	Hytherm CG Inverted Top Layer (mm)	Typical overall insulation (mm)
0.33	0		120
0.28	0	140	140
0.25	0	160	160
0.21	60	140	200
0.20	70	140	210
0.18	60	160	220
0.15	100	160	260
0.13	110	200	310
0.11	160	200	360

*Roof structure = minimum 200mm reinforced concrete

**p=value for average rainfall during warm season (depending on location)

f.x = (determined by WFRL) = increased rate of heat loss caused by the portion of average rainfall which reaches the waterproofing system.

HYTHERM CG INVERTED – Product Characteristics

Product characteristics to EN 13167 + λ_u or λ_{cor} for inverted roof	Measure unit	Value	Standard
Reaction to fire		Euroclass A1, non-combustible, no toxic fumes	EN 13501-1
Density (+15%)	kg/m ³	100	EN 1602
Thickness \pm 2mm	mm	from 100 to 200mm	EN 823
Length \pm 2mm	mm	600 + 3mm	EN 822
Width \pm 2 mm	mm	450 + 3mm	EN 822
Squareness \pm 2 mm	mm	$S_{1b} < 5\text{mm/m}$, $S_d < 2\text{mm}$	EN 824
Flatness \pm 2 mm	mm	< 2mm	EN 825
Thermal Conductivity	W/mK	for inverted roof - design value u or $\lambda_{cor} < 0.043$	EN ISO 10456
Point load	mm	PL < 1.5	EN 12430
Point load top		PL < 1 (< 0.5)	EN 1230

Product characteristics to EN 13167 + λ_u or λ_{cor} for inverted roof	Measure unit	Value	Standard
Compressive strength	kPa	CS \geq 400	EN 826 Annex A
Bending strength	kPa	BS \geq 400	EN 12089
Tensile strength	kPa	TR \geq 100	EN 1607
Dimensional stability after 48h @ 70°C & 90% RH		DS(70,90), $\Delta\epsilon_{l,b} \leq 0.5\%$, $\Delta\epsilon_d \leq 1\%$	EN 1604
Water absorption on short term		WS ≤ 0.5 kg/m ²	EN 1609
Water vapour transmission		∞	EN12086

BBA Certificate Pending

Product Characteristics	Measure unit	Value	Standard
Service temperature limits	°C	-265 to +430	
Water vapour resistance	μ	∞	EN ISO 10456
Hygroscopicity		zero	
Capillarity		zero	
Melting point	°C	>1000	cf DIN 4102-7
Thermal expansion coefficient	K ⁻¹	9×10^{-6}	EN 13471
Specific Heat	J/(kgK)	1000	EN ISO 10456

Axter Water Flow Reducing Layer (WFRL)

The Axter water flow reducing layer is a high performance spun bonded polyethylene geotextile, which helps to minimise heat loss caused by rainwater cooling and consequently the thickness of insulation required.

Nominal characteristics		
Roll size	Length 100m Width 3m 300m ² *	Length 50m Width 1.5m 75m ²
Water vapour resistance (MN.s.g-1)	0.17	
Head of water test	No penetration	
Mass per unit area (g.m-2)	60	
Lap joints unsealed	300mm	

* Not allowing for overlap (300mm)

Hytherm CG Inverted Design & Installation Recommendations

- U-value calculations should be carried out in accordance with local regulations.
- Concrete roof slab to fall, in accordance with BS 6229 : 2018.
- It is essential that roof falls and drainage paths are correctly designed to avoid ponding and subsequent risk of silt build up and stresses in freezing conditions.
- Hytherm CG Inverted roof insulation system is designed for use on buildings with an internal temperature of minimum 5°C.
- When the inverted insulation system includes two-layers of Hytherm CG, the thickness of the first and second layers must be determined in accordance with the manufacturer's recommendations (ratio thickness bottom layer vs thickness top layer) - see the typical U- value tables above.
- The flatness and general condition of the concrete roof slab are important criteria; consult Axter Ltd for further guidance on suitability of substrates. Under a straight (reference) bar of 2m, the unevenness should be less than 5 mm or 3 mm under a straight (reference) bar of 0.6 m.
- During installation care must be taken not to damage the Axter roof waterproofing system.
- The ballast layer must be installed to prevent wind uplift and provide complete protection to the WFRL from UV degradation.
- Gravel ballast (rounded low fines of nominal size 16 mm to 32 mm) should be washed and laid to a minimum thickness of 50 mm and must comply with the specification. Gravel ballast and paving should meet wind uplift requirements and comply with regulations.
- Care must be taken to ensure that refurbished roofs are capable of carrying the increased load and depth of the installed system.
- Adequate measurements must be taken during installation to prevent damage of the top coating of Hytherm CG Inverted.
- Point loads need to be avoided at all times during the installation and specifically when installing the WFRL and roof finishes.
- A protective board must be used to distribute load on top of the Hytherm CG Inverted during installation.

Continuous supports

The deck must be clean, dry and free of any irregularities. Irregularities of the deck must not exceed 3mm over 600mm or 5 mm over 2 m.

In the case of a concrete roof slab and if required an appropriate levelling screed should be applied.

If composed of pre-cast concrete beams, irregularities must not exceed 3mm between each section.

Application of Hytherm CG Inverted should preferably take place when the ambient air temperature and temperature of the deck/roof slab are above 5°C.

All expansion and movement joints should be continued through the structure.

The Axter roof waterproofing must be installed in full compliance with the Axter specification prior to installation of the Hytherm CG Inverted insulation which must be entirely supported by the substrate.

When using two layers of insulation the top layer of Hytherm CG Inverted must be fully supported by a level first layer of Hytherm CG. If this cannot be achieved, the underside of the base layer of Hytherm CG can be adapted by trimming and shaping to ensure it lies flat on the level substrate. Dust from this process must be removed prior to installation of the insulation.

Cutting Hytherm CG Inverted insulation

Hytherm CG Inverted is easy to cut and adjust to make fitting pieces (minimum 15 cm) and/or to create staggered joints.

It can also be sanded to make minimal adjustments; dust must be removed before the insulation is laid.

A wood saw is not recommended.

For minimum cutting on site a metal saw with a hardened steel blade is recommended. If the amount of board to be cut is significant, a more powerful saw is needed to ensure clean cuts with uniform edges with no damage to the coating edge.

The cut edges of the board should be to the outside to prevent open joints and poor fits between boards.

To cut round holes, make a tube of the correct diameter and press this into the coated side of the board, down towards the non-coated underside, to avoid coating damage. Bigger holes to be cut manually.

Hytherm CG Inverted – one layer system

Ensure the Hytherm CG Inverted is loose laid with staggered and tight-butted joints on a flat substrate covered with the Axter roof waterproofing system.

There should be no open joints or gaps, especially at edges and other details or penetrations.

Layout should be optimised to avoid cutting infill pieces to close gaps to less than 15 cm width.

Ensure insulation is stable, adjust where necessary.

Hytherm CG Inverted – two layer system

The first layer of Hytherm CG is loose laid with staggered joints on a flat substrate covered with the Axter roof waterproofing system. Ensure the boards are stable, adjust where necessary.

If there are slight differences in levels, it might be necessary to sand the top surface of the first layer of Hytherm CG boards to ensure a level surface to support the top layer of insulation.

The top layer of Hytherm CG Inverted boards is loose laid; all joints to be staggered between boards in this layer and with joints in the layer below.

Ensure there are no open joints or gaps, especially at edges and other details or penetrations.

Layout should be optimised to avoid cutting infill pieces to close gaps to less than 15 cm width.

Install the Axter Water Flow Reducing Layer (WFRL) in accordance with Axter's instructions.

Install roof finishes in accordance with the manufacturer's instructions.

Care should be taken if walking on the Hytherm CG Inverted boards during installation. Use protection boards to create access walkways if required.

Point loading on the coated surface of the insulation board must be avoided.

Details

Hytherm CG Inverted boards should be installed to parapets and upstands before the first and/or final layer of insulation is laid on the main field area followed by pavers and/or ballast.

Damage

Care must be taken not to damage the coating of the Hytherm CG Inverted boards during installation of the WFRL and the roof finishes (ballast/paving, etc). Protection boards should be used to create a walkway if required. Adequate measures should be taken to avoid point loading on to the insulation board coating.

Damage to the coating of the Hytherm CG Inverted boards must be repaired. If coating has flaked off or there are small areas of damage, these can be repaired with a grey coating repair paste, applied by spatula, ensuring a smooth, level surface is restored. Consult Axter for further information.

Boards with significant damage should not be installed and, if boards are damaged after installation, they must be repaired or replaced. Damaged coating will impair the efficiency of the insulation.

Safety

Follow the safety instructions in the Axter Hytherm CG MSDS.

PPE required includes gloves, standard protective long-sleeved clothing and safety goggles while handling. When cutting, grinding, crushing, or drilling Hytherm CG Inverted, wear safety goggles with side shields or dust goggles while cutting or shaping in breezy conditions.

A mouth dust mask (type FFP1 or higher) is recommended when cutting or shaping, but not essential as Hytherm CG Inverted dust is not toxic.

*Axter Product Data Sheets are also available on Hytherm CG Adhered, Torched and Tapered insulation. Please contact Axter to obtain copies or for technical and design assistance.

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