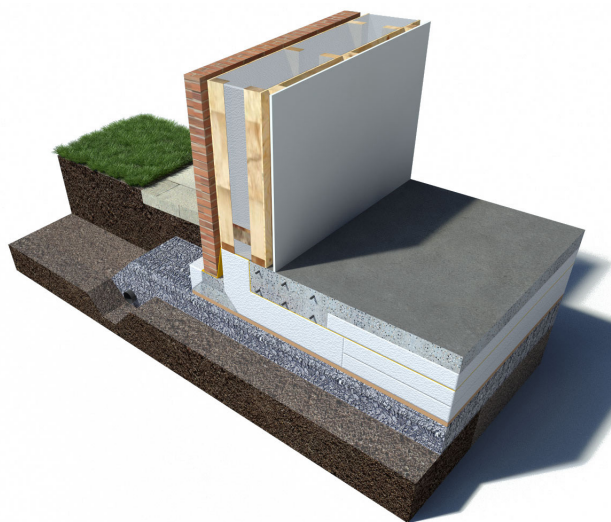




KORE Passive Slab

Insulated Foundation System Design Guide

KORE Passive Foundation System



Key Features

- Meets and exceeds building regulations
- Eliminates the critical wall to floor cold bridge
- Reduces underfloor heating loss through rising walls from 65% to 12%
- Reduces the quantity of concrete for foundation by 50%
- Suitable for all ground conditions while easily accommodating the radon barrier
- Risk of condensation, fungus and mould growth behind the skirting board is eliminated
- The thermal capacity of KORE EPS will not diminish over time and is unaffected by water
- Easy to work with and install
- Exceptional compressive strength makes the product suitable for use in domestic and commercial applications
- Suitable for use with underfloor heating systems

Application & Description

Application

The KORE Passive Slab is an insulated foundation system that works much like a raft foundation. It is used for the construction of ground floors.

Description

The KORE Passive Slab is an Insulated Foundation System that works much like a raft foundation. The KORE Passive Slab EPS300 product allows the foundations to be built on structural grade expanded polystyrene (EPS300). The KORE Passive Slab effectively wraps the foundation of the building with EPS insulation ensuring there is no thermal break between the wall and foundation, while not compromising on the structural strength of the foundation. The structural strength of the KORE Passive Slab results from the combination of EPS300, concrete and steel. Typical size loads for a two storey house built with standard concrete block work are 4.5/5.5 tonnes per linear metre. The KORE Passive Slab can be designed to accommodate these loads with spare capacity. The KORE Passive Slab is combined with our KORE Floor Insulation product - specifically KORE Floor EPS100 White, to give a complete floor insulation solution with U-values ranging from 0.09 to 0.10W/m²k.

Product Name

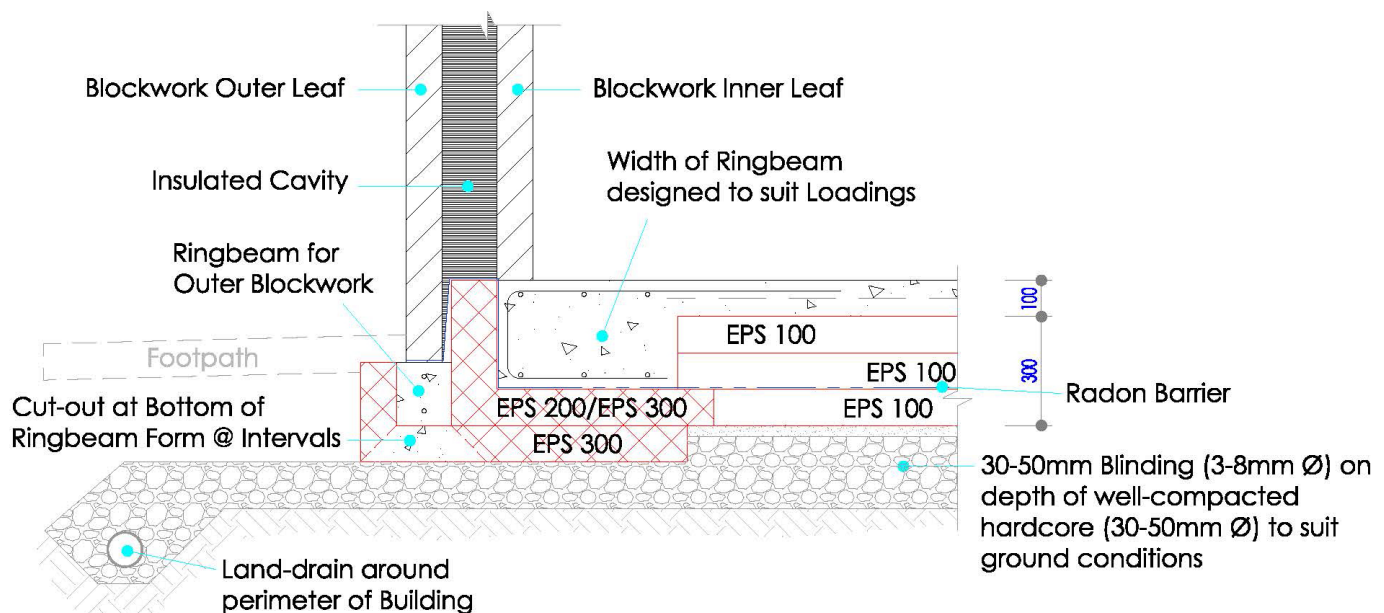
Product Name	Application	New Build
KORE Passive Slab L EPS300 White	Ground Floor	Yes
KORE Passive Sheets EPS300 White	Ground Floor	Yes
KORE Floor EPS100 White	Ground Floor	Yes

Typical Construction & U-Value Calculations

Calculation Assumptions

All U-value calculations are in accordance with BS EN ISO 6946:2007. Ground floor U-value calculations are different from wall and roof calculations in that reference to the construction detail alone is not sufficient to calculate the U-value. The floor area and the perimeter of the external wall and the thickness of the wall must be known to calculate floor U-values correctly. In the case of a basement the perimeter, area, thickness of the wall and the depth of the basement must be known and included in the calculation. When determining the floor dimensions internal measurements must be taken. Heated spaces that are considered unused (stairwells) that are within the heated space should be included. Unheated spaces outside of the insulated fabric should be excluded when calculating the area. Examples include garages or porches. However, the length of the wall between the heated and unheated parts of the building should be included when calculating the perimeter. When considering the U-value for an extension to the existing building, the floor dimensions of the extension only should be considered in the calculations. The thermal conductivity of the ground was taken as 2.0W/mK (sand and gravel) in all calculations below. The Passive Slab L detail was taken into account in the boundary conditions in each calculation.

Detail 1: Passive Foundation Detail: Blockwork Wall Foundation Double L

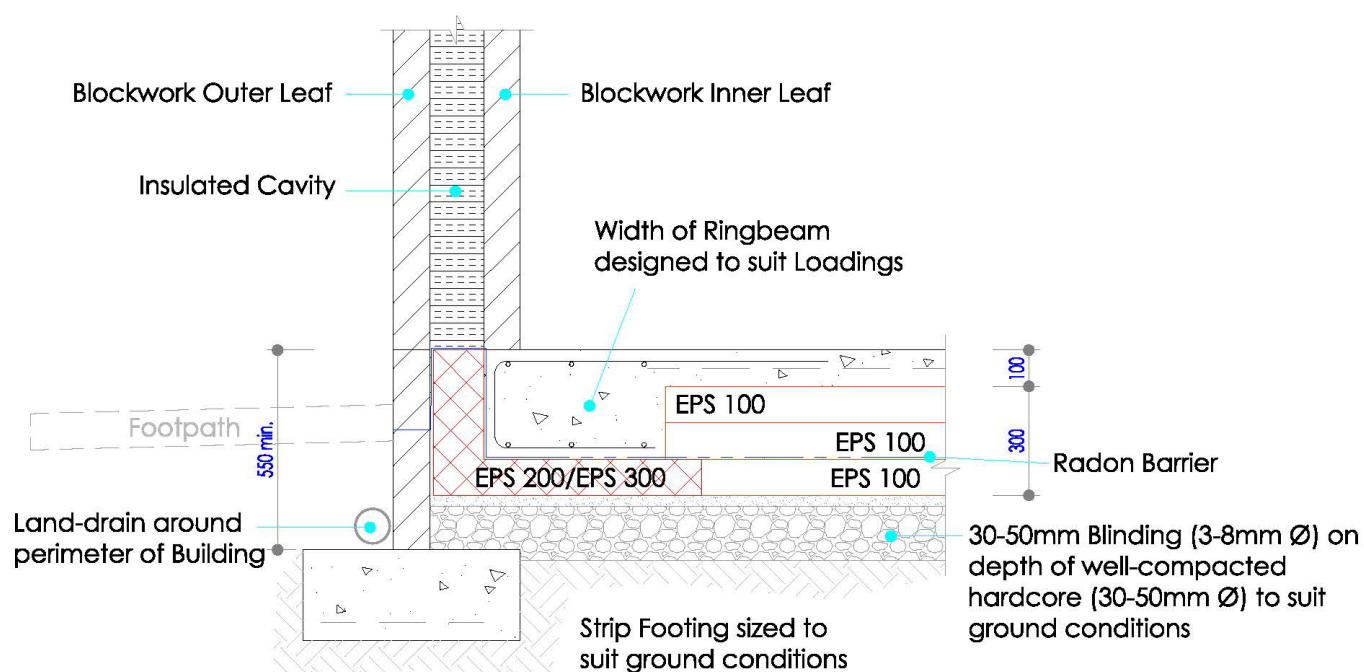


U-Value Calculations: KORE Passive Slab EPS300 White (0.032W/mK) & KORE Floor EPS100 White (0.036W/mK)

Insulating Thickness (mm)	Perimeter/Area (m ²)					
	0.2	0.3	0.4	0.5	0.6	0.7
U-Value W/m ² k						
300	0.09	0.10	0.10	0.10	0.10	0.10

Typical Construction & U-Value Calculations

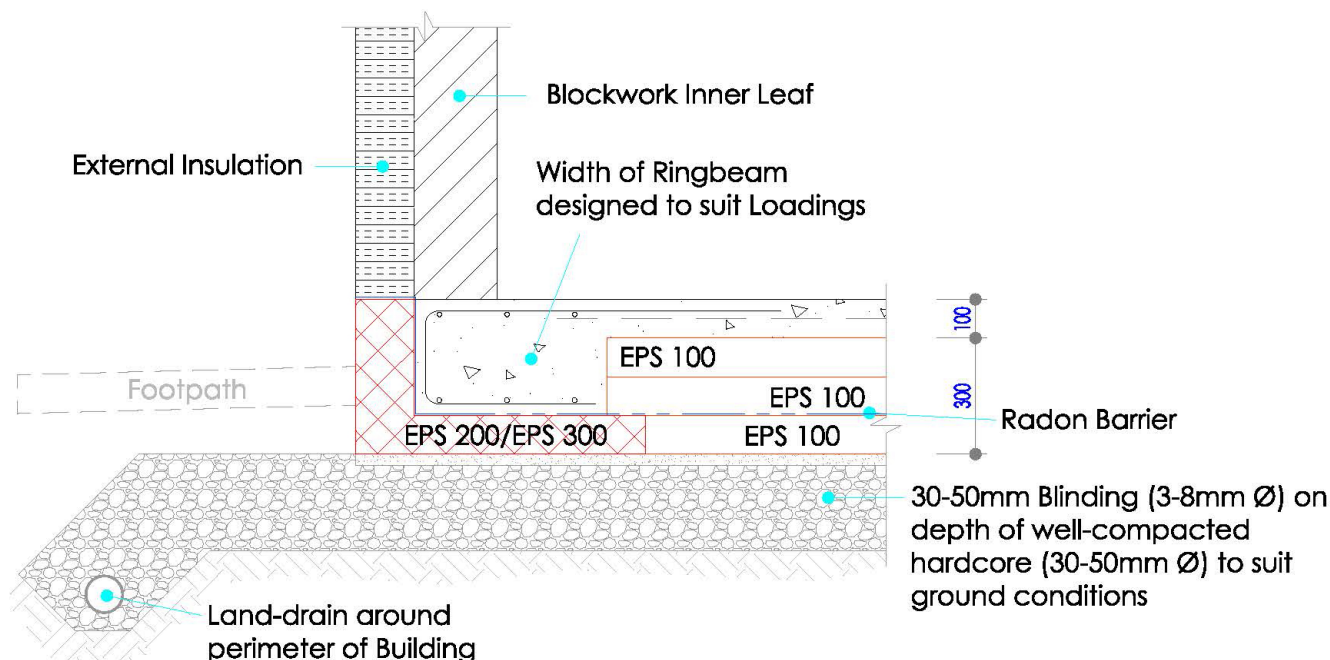
Detail 2: Passive Foundation Detail - Blockwork Wall Foundation Single L



U-Value Calculations: KORE Passive Slab EPS300 White (0.032W/mK) & KORE Floor EPS100 White (0.036W/mK)

Insulating Thickness (mm)	Perimeter/Area (m ²)					
	0.2	0.3	0.4	0.5	0.6	0.7
U-Value W/m ² k						
300	0.09	0.10	0.10	0.10	0.10	0.10

Detail 3: Passive Foundation Detail - Solid Blockwork Wall Foundation

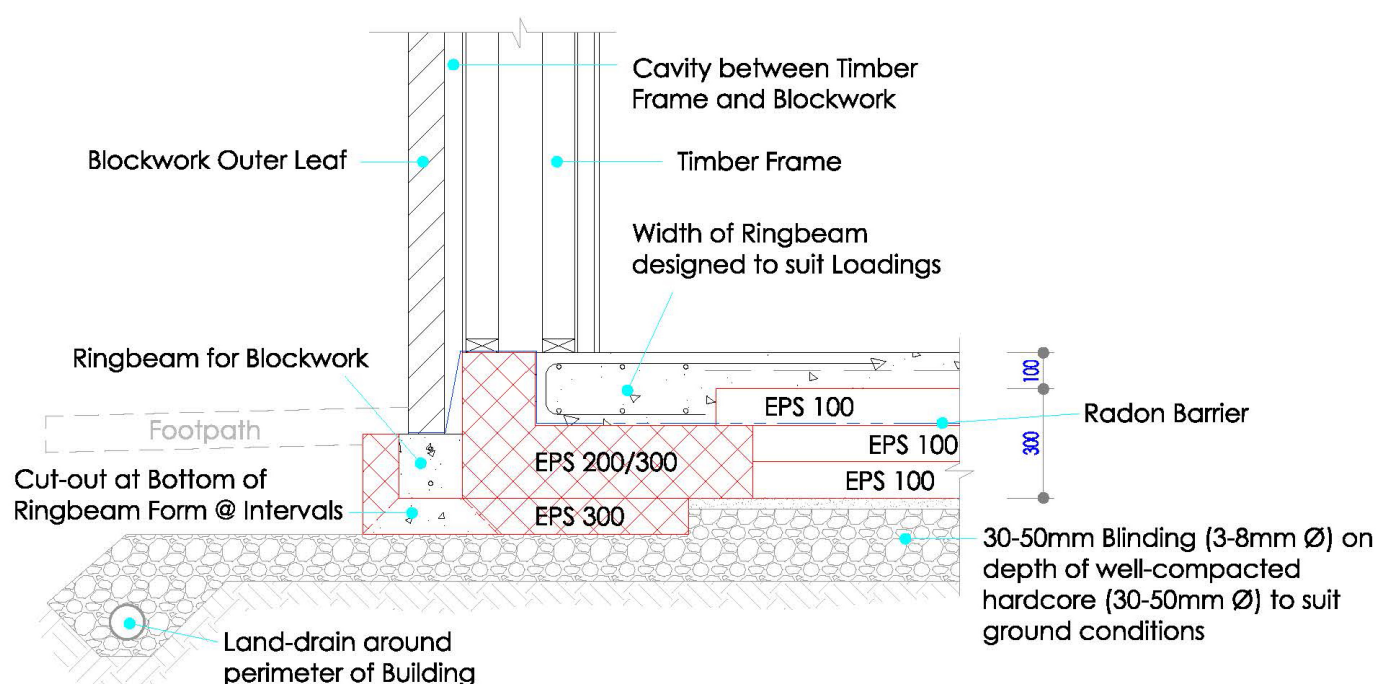


Typical Construction & U-Value Calculations

U-Value Calculations: KORE Passive Slab EPS300 White (0.032W/mK) & KORE Floor EPS100 White (0.036W/mK)

Insulating Thickness (mm)	Perimeter/Area (m ²)					
	0.2	0.3	0.4	0.5	0.6	0.7
U-Value W/m ² k						
300	0.09	0.10	0.10	0.10	0.10	0.10

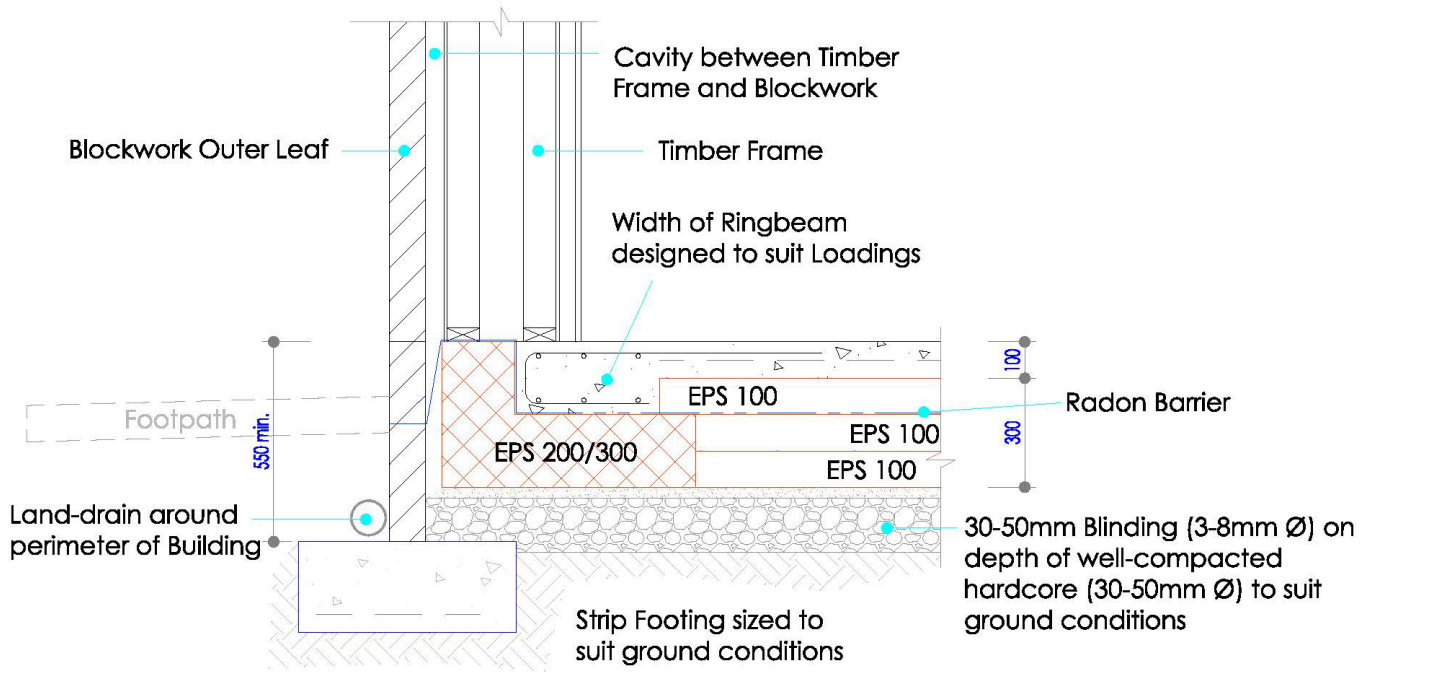
Detail 4: Passive Foundation Detail - Timber Frame Wall Foundation Single L



Insulating Thickness (mm)	Perimeter/Area (m ²)					
	0.2	0.3	0.4	0.5	0.6	0.7
U-Value W/m ² k						
300	0.09	0.10	0.10	0.10	0.10	0.10

Typical Construction & U-Value Calculations

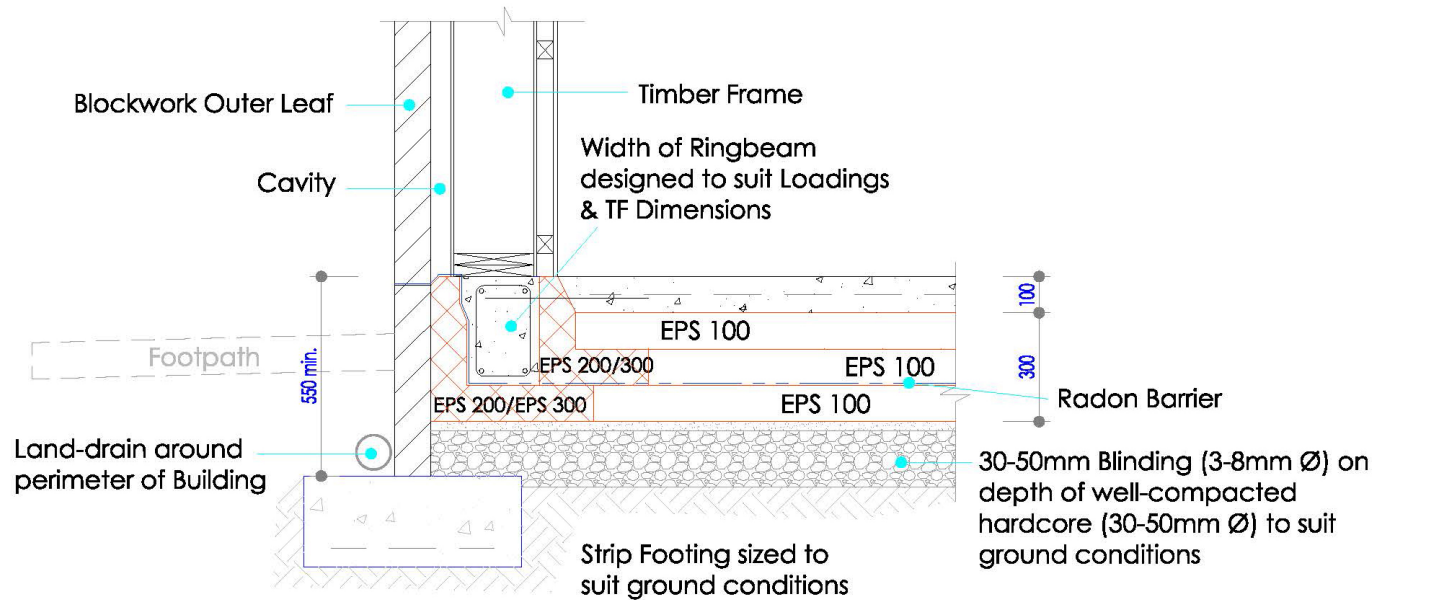
Detail 5: Passive Foundation Detail - Timber Frame Wall Foundation Single L (Strip Blockwork Detail)



U-Value Calculations: KORE Passive Slab EPS300 White (0.032W/mK) & KORE Floor EPS100 White (0.036W/mK)

Insulating Thickness (mm)	Perimeter/Area (m ²)					
	0.2	0.3	0.4	0.5	0.6	0.7
U-Value W/m ² k						
300	0.09	0.10	0.10	0.10	0.10	0.10

Detail 6: Passive Foundation Detail: Timber Frame Wall Foundation Double L

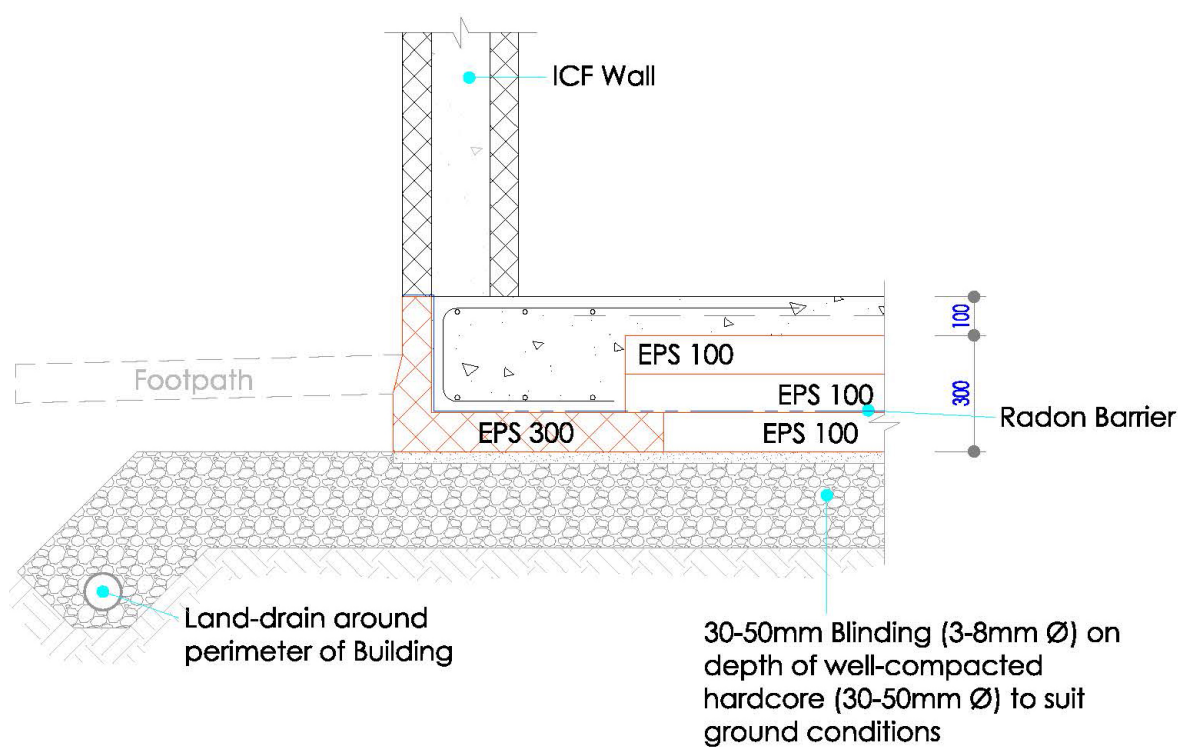


Typical Construction & U-Value Calculations

U-Value Calculations: KORE Passive Slab EPS300 White (0.032W/mK) & KORE Floor EPS100 White (0.036W/mK)

Insulating Thickness (mm)	Perimeter/Area (m ²)					
	0.2	0.3	0.4	0.5	0.6	0.7
U-Value W/m ² k						
300	0.09	0.10	0.10	0.10	0.10	0.10

Detail 7: Passive Foundation Detail - ICF Wall Foundation Single L

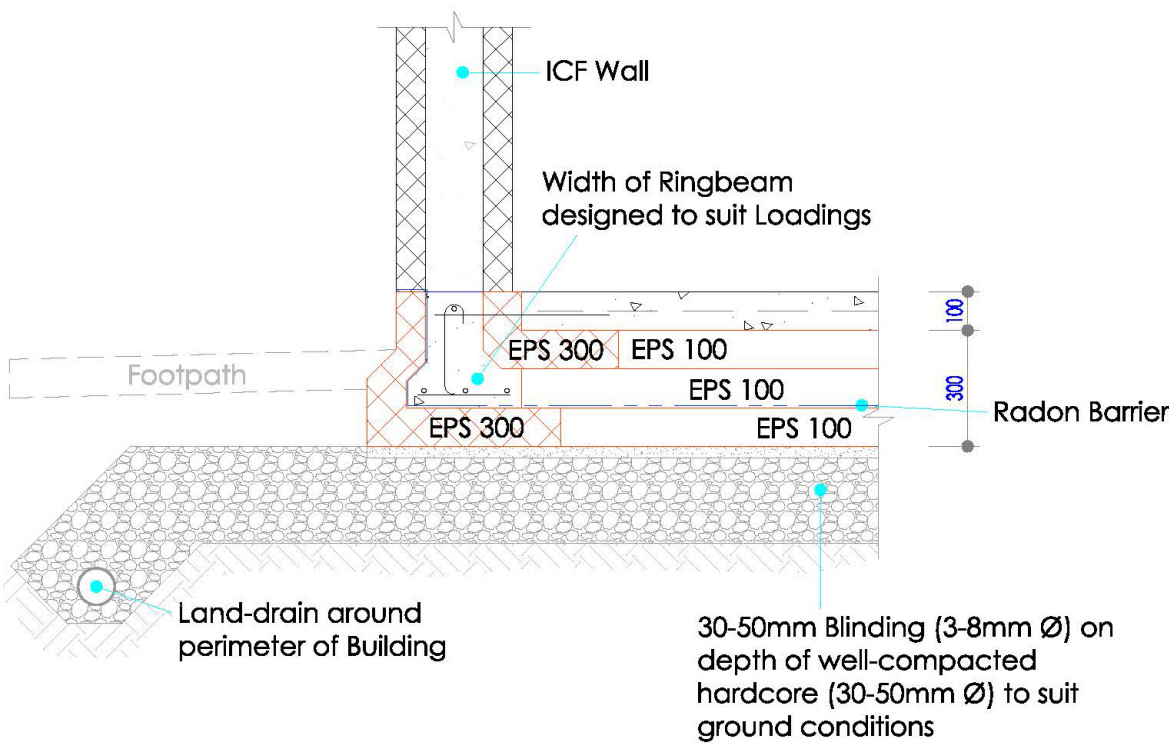


U-Value Calculations: KORE Passive Slab EPS300 White (0.032W/mK) & KORE Floor EPS100 White (0.036W/mK)

Insulating Thickness (mm)	Perimeter/Area (m ²)					
	0.2	0.3	0.4	0.5	0.6	0.7
U-Value W/m ² k						
300	0.09	0.10	0.10	0.10	0.10	0.10

Typical Construction & U-Value Calculations

Detail 8: Passive Foundation Detail - ICF Wall Double Foundation



U-Value Calculations: KORE Passive Slab EPS300 White (0.032W/mK) & KORE Floor EPS100 White (0.036W/mK)

Insulating Thickness (mm)	Perimeter/Area (m²)					
	0.2	0.3	0.4	0.5	0.6	0.7
U-Value W/m²k						
300	0.09	0.10	0.10	0.10	0.10	0.10

Thermal Bridging

TGD Part L of the Irish Building Regulations states that care must be taken to ensure the continuity of insulation and to limit local thermal bridging and that any thermal bridge should not pose a risk of surface or interstitial condensation. KORE have undertaken a thermal bridging analysis of KORE Passive Slab Foundation System at this typical junction. Please contact our team today to request a copy of these results.

Specification Guidelines

This design guide should be read in conjunction with (1) the KORE Floor Insulation Design Guide found on www.kore-system.com and (2) KORE Passive Slab Engineering Report, also available on the kore-system.com website.

Building Standards

KORE Passive Slab can satisfy the requirements of the Irish Building Regulations as outlined in:

- Part L - Conservation of Fuel and Energy - Dwellings (2011)
- Part L - Conservation of Fuel and Energy - Buildings other than Dwellings (2008)

Environmental

Expanded polystyrene is BRE Green Guide A+ Rated.

Design Standards

The following standards should be consulted regarding the construction of floors:

- BS 8215:1991 Code of practice for the design and installation of damp proof courses in masonry construction
- BS 8102:1990 Code of practice for protection of buildings against water from the ground
- BRE GBG28 Domestic Floors: construction, insulation and damp-proofing
- BRE GG74 Radon protection for new dwellings
- BS 6399-1:1996 Loading for buildings - Code of practice for dead and imposed loads
- BS 8203:2001 Code of practice for the installation of resilient floor coverings
- BRE Digest Nos. 240, 241 and 242

Basis of Design

The load bearing elements of the KORE Passive Slab are made from high strength expanded polystyrene, namely EPS300. The '300' signified the short term load, in kPa (or kN/m), that causes a 10% compression of the expanded polystyrene (EPS). At this level of loading, the EPS has exceeded its yield point, so accepted best practice is to use the 1% compression load, that is, the load that causes the EPS to compress by 1%. The industry accepted 1% compression load for EPS300 is 120kPa. The load exerted on the top surface of the EPS300 spreads through the EPS at an approximate angle of 45 degrees (this only holds true for

shallow depths), provided the EPS300 extends far enough beyond the concrete element on top of it. Thus the load, when transferred to the ground under the EPS, is spread over a larger area, reducing the intensity of the load.

Bearing Capacities of Soils

It is not possible to give an accurate bearing capacities of soils without a proper visual and test based assessment of the soil at any particular site. However, different soil types generally fall into a range of bearing capacities, depending on their primary constituent. The table below gives a range of values for the main soil types, but the soil on the site should always be assessed by a qualified engineer to confirm its likely bearing capacity as it is unlikely to fall into just one of the main categories. Other factors that have an influence on the bearing capacity of a soil are its native stiffness/compactness and how far the foundation is above the water level, if at all.

In no case should a building be founded on topsoil, or soil with organic matter in it, as these soils will expand and shrink with changing moisture contents and would cause the building above to move, most likely causing damage to the building. Unless there is a great depth of these types of soil, they should be excavated to non-organic soil level. Where there are great depths of these soils, other options may need to be considered such as piling. A suitably qualified engineer will advise on the best solution in these circumstances.

Great care also needs to be taken when building on shrinkable clays (prevalent in parts of the UK). These clays also expand and shrink with changing moisture contents (not to the same extent as top soils) and are greatly influenced by the presence of trees in the vicinity of the building. Foundations in these clays generally need to be taken to greater depths than normal to minimise variations in moisture content over time that will cause clays to shrink and expand, thus causing the foundations and building to move, possibly causing damage. In some circumstances, piled foundations may be required or be the most economical way to avoid excessive movement in the foundations. Piles for lightweight structures such as houses, do not need to be large, but they transfer the superimposed loads to a much greater depth, where moisture contents are practically constant and thus shrinkage and expansion of the clays is not an issue. An alternative to piling that is also worth considering is the use of Vibro Stone Columns. These are columns of stone that are vibrated into the ground, consolidating the ground around them and providing columns of highly compacted stone that transfer the superimposed loads to greater depths, as with

Specification Guidelines

piles. Each option outlined above is compatible with the KORE Passive Slab. In shrinkable clays, a suitably qualified engineer should be consulted to advice on the most appropriate foundation solution. Further information on shrinkable clays can be found in Building Research Establishment (BRE) Digests No's 240, 241 and 242.

Soil Type	Bearing Capacity (kPa)	Remarks
Dense gravel; dense sand & gravel	>600	Water table at least width of foundation below base of foundation
Medium dense gravel; medium dense sand & gravel	200-600	
Loose gravel; loose sand & gravel	<200	
Compact sand	>300	
Medium dense sand	100-300	
Loose sand	<100	
Very stiff boulder clay; hard clays	<100	Susceptible to long-term consolidated settlement
Stiff clays	150-300	
Firm clays	75-150	
Soft clays and silts	<75	
Very soft clays and silts	-	

Ref: Table taken from 'Craigs Soil Mechanics' by Knappett, JA. and Craig, RF. 8th Ed.

Improving Bearing Capacities of Soils

A proper site investigation should be carried out to determine the soil properties at depth, as the poorest soil is not always nearest the surface, and may in fact underlie a better soil layer nearer the surface. A simple trial hole will probably suffice for many sites, but a more in-depth investigation may be necessary where ground conditions are particularly poor.

Where soils are deemed to be too weak to support the loads imposed on them, a number of options can be considered to allow them to be built upon. Most options do not improve the bearing capacity of the native soil, per se, but they reduce the bearing pressure on the native soil such that loading exerted from the new building will not have an adverse effect on the native soil.

For KORE Passive Slab Insulated Foundation System, the standard depth of hardcore under the EPS is 150-225mm of

18-35mm hardcore, compacted in layers appropriate to the compaction method. The most common approach adopted where underlying soils are weak is to increase the depth of this hardcore layer. Since the load spreads as it travels downward, the deeper the hardcore, the smaller the load exerted on the underlying soil. This works because the hardcore has a predictably suitable bearing capacity to take the higher intensity bearing pressures nearer the surface. It is also strongly advised, especially in poorer ground, to lay a geotextile on the excavated surface before placing the hardcore under the KORE Passive Slab. This layer helps to spread the loads further and also prevents fines in the underlying soil migrating into the hardcore, which would reduce the bearing capacity of the hardcore.

For very poor soils, other options may need to be considered, such as piling or other specialist ground improvement methods such as Vibro Stone Columns, as discussed briefly in the previous section.

Drainage

All KORE Passive Slab foundations must incorporate a land-drain around the perimeter of the building at a depth of at least 600mm below ground level to prevent frost heave in very cold weather. Frost heave can happen if water is present near the underside of the foundation; it could freeze due to the shallow depth, and because the water expands when it turns to ice this could cause the foundation above it to rise and move, possibly causing damage to the building.

Point Loads

The capacities calculated for each arrangement are for linear loads, that is, the maximum line load that a particular arrangement can support. If there are point loads on the foundation, proper account needs to be taken of these to ensure the capacity of the EPS is not exceeded, even locally. Often there is some spare capacity in the foundation, that is, the line load applied is not as large as the capacity of the foundation, so by using appropriate reinforcement the point load can be spread over a length of the foundation such that the capacity of the foundation is not exceeded. Where point loads are large and there is insufficient spare capacity in the foundation, other measures need to be taken, such as constructing a pad footing under the insulated foundation and connecting this to the insulated foundation such that the excess load is transferred to the pad footing and is supported directly on the ground. For internal point loads, it is usually sufficient to create a pad footing within the insulation, with EPS300 underneath, thus avoiding the slight thermal bridge

Specification Guidelines

introduced by the arrangement described above.

Reinforcement

Steel reinforcement is used in the ringbeam and floor slab to distribute loads and control cracking in the concrete. The ringbeam reinforcement usually consists of 4 number reinforcing bars; 2 number near the bottom of the beam and 2 number near the top. Sometimes shear links are also used in the ringbeam, depending on the load intensities and arrangements. The floor slab incorporates a layer of steel mesh reinforcement, principally to control cracking in the slab, as the floor slab is not divided up by rising walls in the way traditional floor slabs were, and thus there is a greater risk of shrinkage across the full slab that will lead to cracking unless controlled. Where the slab is thickened to support internal load bearing walls or columns, reinforcement bars or mesh is used near the bottom of the thickening to spread the loads over the full area of the thickening.

Fire Stops

With respect to heating appliances, flue pipes or openings to a heating appliance, KORE Floor should be separated by a solid non-combustible material not less than 200mm.

Resistance to Moisture

KORE Passive Slab will not allow moisture to cross the floor construction once it is installed as per the installation instructions in this design guide.

Detailed Specification Guide

Full specification guide is available on www.kore-system.com

On Site

The installation instructions below are a guide only. They should not replace the instructions of a suitably qualified engineer and their specific site specifications.

Installation Guidelines

- The site is prepared for the KORE Passive Slab according to the instructions of a suitably qualified engineer. Typically this includes clearing the topsoil and digging to a soil level that is free from vegetation.
- A minimum of 150mm 18-35mm stone is compacted

into 50mm layers on the site. The thickness of the stone layer will depend on the site specific conditions. The stone can be compacted using a suitable roller or by compacting each layer with a 125kg plate compactor.

- Services should be considered at this point and a void formed in the stone to take services at a later stage
- A 10-22mm layer of 804 concrete binding or equivalent is installed over the compacted stone. This binding layer must be leveled to a tolerance of +/- 2-3mm over the entire surface of the foundation.

- Starting at the highest point, at a corner point, in the case of a double L arrangement the outer EPS300 L piece is set in place. The corner pieces are cut on site to ensure a close butting of sheets at each corner. The EPS300 can be easily cut to suit any angle required by the design. The entire outer L is placed in the foundation first, followed by the inner L.
- For services that need to penetrate the outer L, the EPS should be cut before the concrete is poured to accommodate a void for fitting services at a later stage.
- Where there are internal load bearing walls a thickening of concrete of 200mm - 300mm must be accommodated. Prior to fitting the floor insulation the space required for the internal load bearing walls is marked out. EPS300 in layers of 100mm or 200mm will be required under the load bearing walls.
- Following the placement of the perimeter EPS300 detail, the first 100mm layer of KORE Floor EPS100 White and KORE EPS300 Sheets (for the load bearing walls) are put in place starting from the perimeter inwards until the entire foundation is covered in insulation.
- KORE Floor Insulation System should be laid with closely butted joints, laid staggered with a break-bonded pattern and fitted tightly at the edges.
- The DPC/radon barrier is placed over the first layer of insulation and runs over the L detail and out.
- The second and third layer of KORE Floor EPS100 White are placed over the DPC/radon barrier.
- Where appropriate a second 100mm layer of EPS300 should be placed at the load bearing walls.
- Steel reinforcement to the specification of a suitably qualified engineer is now put in place and tied in the appropriate manner. Reinforcing bars are used in the outer ring beam and at internal load bearing walls. A steel mesh is used on the concrete slab.
- When fitting underfloor heating pipes, the pipes can be clipped to the steel mesh or to the KORE Floor Insulation.
- The perimeter of the KORE Passive Slab must be braced appropriately for the concrete pour to avoid the EPS moving from the pressure of the concrete. Typically this can be achieved by clipping the perimeter strips together using U shaped steel clips, by using timber bracing fixed to the outside of the L piece or by backfilling the outer L with 18-35mm stone.
- 25 to 30 N concrete (this specification will vary depending on the requirements of the engineer) is poured into the ringbeam and slab in one pour. The concrete is vibrated to ensure appropriate steel/concrete coverage.
- Care should be taken to avoid damage to the insulation or DPM and radon barriers as the slab is being poured

and operatives should make use of barrow runs and walkways whilst installation progresses.

- Airtightness details between the floor and the wall structure must be considered and best practice adopted.

Cutting

On-site trimming of boards where necessary to maintain the continuity of insulation is easily executed using a fine tooth saw or builder's knife. Care must be taken to maintain the thickness, flatness and squareness of the board to achieve close butting of joints and continuity of insulation.

Packaging and Storage

KORE Passive Slab Insulation and KORE Floor Insulation boards must be protected from prolonged exposure to sunlight, and should be stored under cover in their original wrapping, not in contact with ground moisture and raised above ground level. Care must be taken to avoid contact with solvents and with materials containing volatile organic components such as tar and newly treated timber.

Product Technical Details

Please see the KORE Floor Design Guide for specific product technical details for the KORE Floor EPS100 White product. This Design Guide deals with KORE EPS300 White specifically.

Properties

Type

KORE Passive Slab Insulation System EPS300 as defined in IS EN 13163:2012. Reaction to Fire Class E, containing a flame retardant additive.

Density

KORE Passive Slab EPS300 White 40kg/m³

Thermal Conductivity

The thermal conductivity of KORE Passive Slab Insulation products are in accordance with IS EN 13163:2012 and EN12667 Thermal performance of building materials and products - determination of thermal resistance by mean of guarded hot plate and heat flow meter method.

- KORE Passive Slab EPS300 White 0.032W/mK

Thermal Resistance

Thermal resistance, known as the R-value, varies with the thickness of the insulation. To calculate the thermal resistance (m².K/W) divide the thickness of the insulation by its thermal conductivity and round down the result to the nearest 0.05.

	KORE Passive Slab EPS300
Thickness Insulation (mm)	Thermal Resistance (m ² .K/W)
100	3.125
150	4.688
200	6.250
250	7.813

Durability

The KORE Passive Slab Insulation System is rot-proof, water repellent and durable.

Behaviour in Fire

When installed and used as per this technical document the increase in fire load in the building consequent to its use is negligible.

Dimensions

Dimensions are project specific.

Tolerances

In accordance with IS EN13163:2012 the following tolerances apply to all KORE Floor Insulation Products

Characteristic	Level/Class/Limit Value	Value (mm)	Standard
Thickness	T2	±2mm	EN823
Length	L2	±2mm	EN822
Width	W2	±2mm	EN822
Squareness	S2	±2mm	EN824
Flatness	P10	±10mm	EN825

Dimensional Stability

KORE Passive Slab EPS300: In accordance with IS EN13163:2012 and EN1603, dimensional stability, DS(N)5, declared value ±0.5%.

Compressive Strength

KORE Passive Slab EPS300: In accordance with IS EN13163:2012 and EN826, compressive strength at 10% deformation, CS(10)300, declared value 302kPa.

Bending Strength

KORE Passive Slab EPS300: In accordance with IS EN 13163:2012 and EN12089, bending strength, BS200, declared value ≥300.

Tensile Strength

KORE Passive Slab EPS300: In accordance with IS EN 13163:2012 and EN1607, tensile strength perpendicular to the surface, TR150, declared value ≥150kPa.

Product Technical Details

Long Term Water Absorption by Partial Immersion

KORE Passive Slab EPS300: In Accordance with IS EN 13163:2012 and EN12087, long term water absorption by partial immersion, declared value WL(P)i 0.1kg/m²

Long Term Water Absorption by Total Immersion

KORE Passive Slab EPS300: In Accordance with IS EN 13163:2012 and EN12087, long term water absorption by total immersion, declared value WL(T)i 4%.

Certification

NSAI Irish Agreement Certificate Number 04/0097 for KORE Floor Insulation

Standards

KORE Passive Slab Foundation System is manufactured to BS EN13163:2012 under Quality System approved to EN ISO 9001:2008 Quality Management.

Technical Services

Contact our team today for:

- U-value calculations
- Condensation risk analysis
- Determination of exposure zone
- Accredited drawings and details
- Thermal bridging analysis results
- Temperature factor analysis

Other Products

KORE Passive Slab Insulated Foundation System can be installed in conjunction with a wide range of KORE products and services. When installing KORE Passive Slab Insulation, consider the following products for a whole-home solution:

- KORE External Wall Insulation
- KORE Fill Bonded Bead Cavity Wall Insulation
- KORE's Range of Draught Proofing Solutions
- KORE Wall and Roof Ventilation
- KORE Hot and Cold Water Lagging and Jackets
- KORE's Pipe Insulation

Contact Details

P +353 49 4336998 F 049 4336823
E info@kore-icf.com W www.kore-system.com

The Green
Kilnaleck
Co. Cavan

Facebook: www.facebook.com/KOREIreland
Twitter: www.twitter.com/KORESsystem

Disclaimer

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KORE PASSIVE
SLAB

A Product of  **AIRPACKS**

The Green, Kilnaleck, Co. Cavan, Ireland