

Masonry cavity walls

Masonry cavity wall design

Wall ties

Apart from structural considerations, which are obviously pre-eminent, the correct specification of wall ties is crucial in two additional respects. Firstly, it is necessary that the tie does not compromise the performance of the cavity wall insulation with regard to liquid water penetration. Secondly, the U-value calculation method must take into consideration the number of wall ties per square metre as well as the cross sectional area, and thermal performance of the wall tie. Stainless steel wall ties can be used for cavities up to 175mm and are recommended because they have a low cross sectional area minimising their impact on the thermal performance of the wall. Where wider cavities are used a two part wall tie is recommended. These are more robust and can have a significant impact on the U-value of the wall. In all circumstances it is recommended that the designer seeks advice from the manufacturer of the wall tie to ensure that the tie selected meets the structural requirements of the building work.

Low thermal conductivity wall ties are also available and are suitable for cavities up to 300mm wide, their thermal performance is such that they have negligible impact on the U-value of the wall.

Masonry cavity walls and fire performance

Open cavities must be stopped to prevent the passage of fire. This is required at specific intervals and the cavity barrier has to provide at least 30 minutes fire resistance. If the cavity is fully filled and is built in accordance with Diagram 13 (Diagram 34 in Volume 2) of Approved Document B: 2007, Volume 1, 'Dwellinghouses' cavity barriers are not required.

Prevention of liquid water penetration

Prevention of liquid water penetration from the outer to inner leaf is one of the major considerations when designing cavity walls. The selection of appropriate materials and jointing methods for the outer leaf are crucial.

Cavity trays

Cavity trays should be provided:

- At all interruptions of the cavity, such as lintels and sleeved vents and ducts
- Above cavity insulation that stops short of the top of the wall

Cavity trays should rise at least 140mm within the cavity, be self-supporting or fully supported with joints lapped and sealed. Stop ends should be provided to the ends of all cavity trays.

Weep holes should be provided at not more than 900mm centres to drain each cavity tray with at least two weep holes per cavity tray.

Condensation risk

In a properly insulated masonry cavity wall there is negligible risk of condensation forming on the inner block leaf.

Condensation may have a detrimental effect on the thermal performance of a structure or cause damp on the inside face of the wall. Un-faced mineral wool products, being 'vapour open' offer negligible resistance to the passage of water vapour through the wall.

The Knauf Insulation Technical Support Team are able to carry out condensation risk calculations if further reassurance is required.

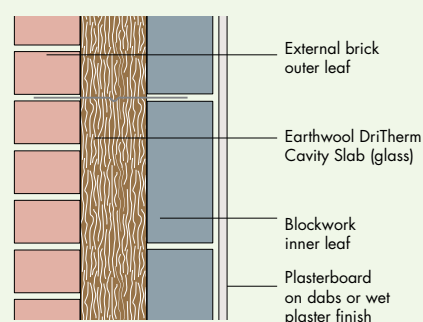
Recommended solutions

The recommended masonry cavity wall solution is full-fill, either injected (Supafil) or built in slabs (Earthwool DriTherm Cavity Slabs).

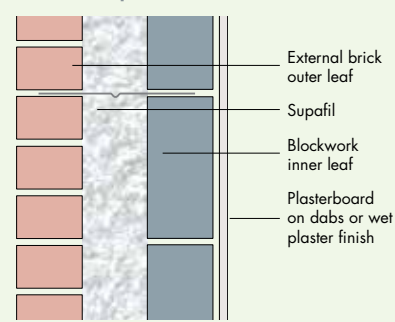
These systems not only provide the best U-value to wall width ratio but are also the lowest in cost. Even with dense concrete blocks it is possible to achieve very high thermal performance in a manageable wall width.

The systems shown do not require cavity barriers, and full-fill systems can be installed in all types of buildings across the built environment, as detailed in their British Board of Agrément (BBA) Certificates. With formal guarantees against liquid water penetration and a long history of use, they offer peace of mind for the specifier, builder and client alike.

1) Full-fill: built-in



2) Full-fill: injected



Solution optimiser and pathfinder

Key

Thermal insulation achievable by constructions within this document.

Pb01 Find online. Visit knaufinsulation.co.uk and key in construction code to find the most up to date information on your chosen solution.



Masonry cavity walls

Full-fill with built-in glass mineral wool



Earthwool DriTherm Cavity Slab

Earthwool DriTherm Cavity Slabs

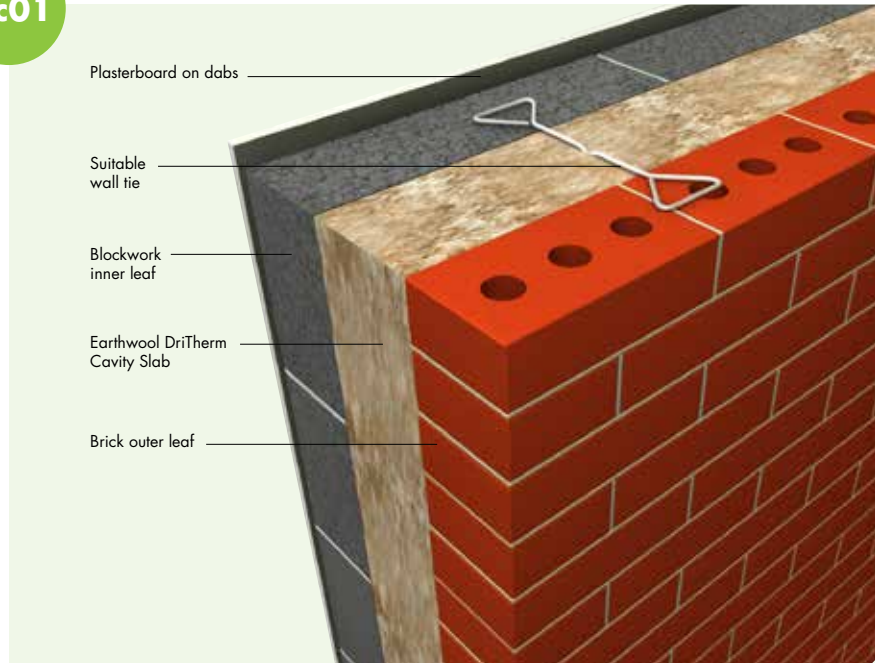


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- Slabs fully fill the cavity and knit together at joints, preventing air movement and infiltration through or around the insulation
- Slabs are installed under compression, preventing moisture penetration and cold bridging at joints
- Low cost, quick and easy to install

Earthwool DriTherm Cavity Slabs

- BBA Certified for all exposure zones
- Non-combustible Euroclass A1 reaction to fire rating
- A+ Generic BRE Green Guide rating
- Zero Ozone Depletion Potential (ODP)
- Zero Global Warming Potential (GWP)



Products

Earthwool DriTherm Cavity Slabs are a range of lightweight semi rigid or rigid slabs of glass mineral wool with a water repellent additive. They are manufactured to fit between wall ties at standard vertical spacings.

Typical construction

Brick or block outer leaf (which may be rendered), brick or block inner leaf with cavity fully filled with Earthwool DriTherm Cavity Slabs. Internal finish of 12.5mm standard plasterboard on dabs.

For buildings from 12m to 25m high, British Board of Agrément (BBA) Certificate No 95/3212 imposes additional requirements. For additional information see the BBA Certificate or contact our Technical Support Team on 01744 766666.

Installation

Earthwool DriTherm Cavity Slabs should be kept clean and free from mortar droppings. All joints should be closely butted. Any cutting and fitting should be neatly done and not distort the layers of glass mineral wool which comprise the product. Damp proof courses should be installed to ensure that penetrating water is directed only to the outer leaf. See pages 126 - 129 for detailed installation instructions.

Performance

Thermal performance

Earthwool DriTherm Cavity Slab 37 Standard has a thermal conductivity of either 0.035 W/mK or 0.037 W/mK depending on thickness.

Earthwool DriTherm Cavity Slab 34 Super has a thermal conductivity of 0.034 W/mK.

Earthwool DriTherm Cavity Slab 32 Ultimate has a thermal conductivity of 0.032 W/mK.

Fire performance

Earthwool DriTherm Cavity Slabs are classified as Euroclass A1 to BS EN 13501-1.

Moisture resistance

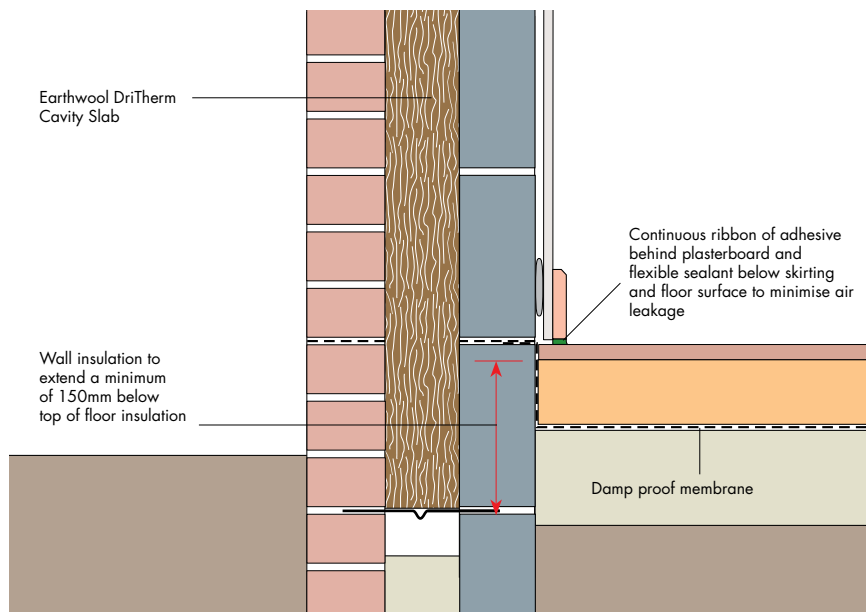
Earthwool DriTherm Cavity Slabs contain a water-repellent silicone additive to ensure that no liquid water is able to pass through the slabs and reach the inner leaf of masonry.

Tests by the British Board of Agrément confirm that Earthwool DriTherm Cavity Slabs will not transmit water to the inner leaf. Nor will they transmit moisture by capillary action across the cavity or from below DPC level.

Vapour resistance

Earthwool DriTherm Cavity Slabs have negligible water vapour resistance, allowing water vapour to pass freely through the slabs.

Typical wall/ground floor junction



Typical specification

All external walls to be insulated during construction by completely filling the cavity with Earthwool DriTherm Cavity Slab 37 Standard*/34 Super*/32 Ultimate*mm thick. (*Delete as appropriate).

The first run of wall ties to be located at 600mm centres horizontally at a level to be determined by the specifier. Subsequent runs of wall ties to be at not more than 900mm centres horizontally, or as otherwise required by the structure, and at 450mm vertically. All work under construction must be protected overnight and during adverse weather conditions in accordance with BS 5628: Part 3: 2005.

nbsPlus

Alternatively, consult the National Building Specifications, Standard version clause/clauses...F30/10 and 150.....

Knauf Insulation specification clauses can be downloaded from knaufinsulation.co.uk/nbs

Typical U-values for fully filled masonry cavity walls

U-values (W/m²K) for brick outer leaf/cavity/100mm block inner leaf, plasterboard on dabs

Cavity width (mm)	Product	Medium block ($\lambda = 0.45$)	High strength aircrete ($\lambda = 0.19$)	Standard aircrete ($\lambda = 0.15$)	Lightweight aircrete ($\lambda = 0.11$)
300	DriTherm 32 Ultimate	0.10	0.10	0.10	0.09
	DriTherm 34 Super	0.11	0.10	0.10	0.10
	DriTherm 37 Standard	0.11	0.11	0.11	0.11
200	DriTherm 32 Ultimate	0.14	0.14	0.14	0.13
	DriTherm 34 Super	0.15	0.15	0.14	0.14
	DriTherm 37 Standard	0.16	0.16	0.15	0.15
150	DriTherm 32 Ultimate	0.19	0.18	0.17	0.17
	DriTherm 34 Super	0.20	0.19	0.18	0.18
	DriTherm 37 Standard	0.21	0.20	0.20	0.19
125	DriTherm 32 Ultimate	0.22	0.21	0.20	0.20
	DriTherm 34 Super	0.23	0.22	0.21	0.20
	DriTherm 37 Standard	0.25	0.23	0.23	0.22
100	DriTherm 32 Ultimate	0.26	0.25	0.24	0.23
	DriTherm 34 Super	0.27	0.26	0.25	0.24
	DriTherm 37 Standard	0.29	0.27	0.27	0.26
85	DriTherm 32 Ultimate	0.30	0.28	0.27	0.26
	DriTherm 34 Super	-	-	-	-
	DriTherm 37 Standard	-	-	0.30	0.28



Note: The U-values have been calculated assuming that all walls are lined with 12.50mm standard plasterboard on dabs on standard blocks with 10mm mortar joints. Wall ties assumed to be stainless steel at 2.5 per m² with a cross-sectional area of no more than 12.5mm² for structural cavities up to 175mm wide. For cavities above 175mm, the cross sectional area of wall ties is assumed to be 25mm². Air gap correction level is zero. Multiple layers are required for several of the solutions detailed above.

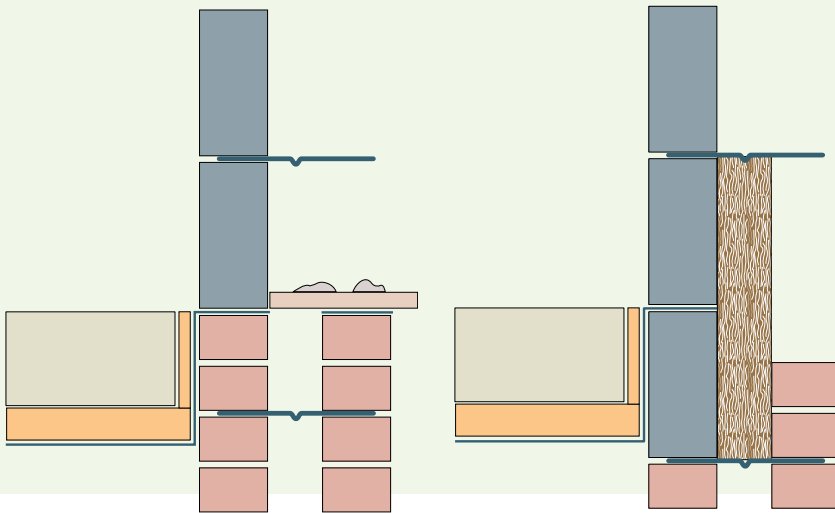
Masonry cavity walls

Full-fill with built-in glass and rock mineral wool

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Installation sequence

- 1 Build up the first stage of one leaf of masonry to include the first row of ties above the commencement of the Earthwool DriTherm Cavity Slab. Clean mortar squeeze from the masonry and snots from any ties or cavity tray.
- 2 Position the Earthwool DriTherm Cavity Slab against the masonry, so that the wall tie drips are halfway across the top edge of the slabs. The Earthwool DriTherm Cavity Slab should be cut to course if necessary. Earthwool DriTherm Cavity Slab should be taken below DPC level (preferably by at least 150mm) to provide edge insulation, with no risk of capillary action. Earthwool DriTherm Cavity Slab does not wick. Always bring Earthwool DriTherm Cavity Slab to course with wall ties.



Installation

The thickness of Earthwool DriTherm Cavity Slab and the cavity width should be designed within the tolerances given in Table (right). It is not possible to compress Earthwool DriTherm Cavity Slab during installation because its resilience will be enough to dislodge bricks before the mortar has set.

Earthwool DriTherm Cavity Slab should be kept clean and free from mortar droppings. All joints should be closely butted. Any cutting and fitting should be neatly done and not distort the layers of glass/rock mineral wool which comprise the material – see 'Problems to avoid' on opposite page. Cavity trays and damp proof courses (dpc's) should be installed to ensure that penetrating water is directed only to the outer leaf.

The illustrations above outline technique only, and do not imply that the outer leaf must be built first.

Construction practice will vary from site to site. Where design details differ from those illustrated please do not hesitate to contact Knauf Insulation for any clarification required.

Wall ties

Earthwool DriTherm Cavity Slab is supplied in 1200 x 455mm slabs for use between wall ties at 450mm vertical centres. Standard butterfly, stainless steel wire ties and vertical twist ties are suitable, as are all ties with a positive drip which will penetrate the top edge of the Earthwool DriTherm Cavity Slab halfway across its width. The use of any other type of tie should be referred to Knauf Insulation Technical Support Team. Advice should also be sought from the wall tie manufacturer as to the maximum cavity width for which the use of a specific tie is approved.

Generally, rows of wall ties should be at 450mm vertical spacing and at horizontal spacings of not more than 900mm or as otherwise required by the structure. Where whole rows of ties are at different vertical spacing, Earthwool DriTherm Cavity Slab should be cut to course, allowing an extra 5mm for compression to form close butt joints. Where extra ties are required, e.g. at the side of openings, Earthwool DriTherm Cavity Slab should be cut and fitted carefully around them. When off-cuts of Earthwool DriTherm Cavity Slab are needed, the slabs can be cut with a long bladed knife or bricklayer's trowel.

Further recommendations

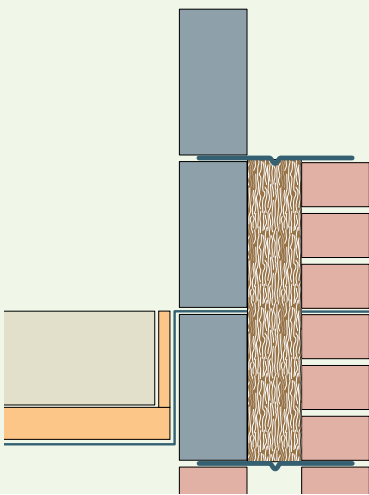
Above, below and beside openings, where cut strips of Earthwool DriTherm Cavity Slab may be needed, particular care should be taken to fit closely and ensure work is clean and free from debris. At the end of the day's work and during rainy periods, any exposed Earthwool DriTherm Cavity Slabs should be covered.

If Earthwool DriTherm Cavity Slab is terminated vertically at an open cavity, a vertical dpc must be fitted up the inside face of the outer leaf to ensure that any mortar droppings on exposed edges do not bridge the cavity.

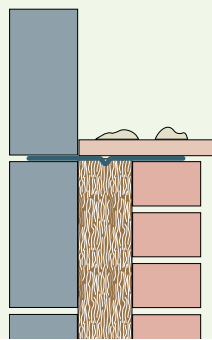
Permitted deviations in cavity widths

Earthwool DriTherm Cavity Slab size and nominal cavity width	Permitted cavity deviation
Thickness (mm)	(mm)
150 or more	-0 or +20
125	-0 or +15
100	-0 or +15
85	-0 or +15
75	-0 or +15
65	-0 or +10
50	-0 or +10

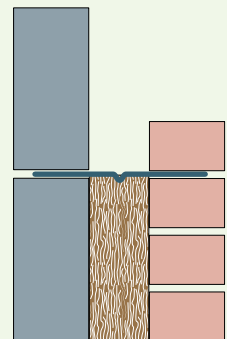
3 The following leaf is then built to the top level of the Earthwool DriTherm Cavity Slab. Do not let the second leaf overtake the Earthwool DriTherm Cavity Slab so as to create a trough (but see 5 regarding choice of leading leaf).



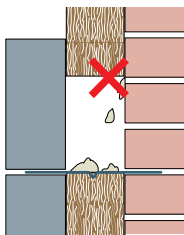
4 Proceed similarly with successive stages of the wall. As with normal masonry cavity construction, no mortar should remain in the cavity. Particular care should be taken to keep slab joints closely butted and free from mortar. To facilitate keeping the top edges of slabs clean it is recommended that a cavity board be used.



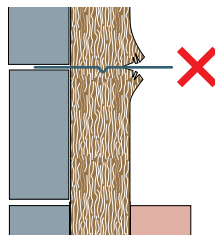
5 Building may proceed leading with either the inner or the outer leaf. When leading with the inner leaf it is recommended to build a trough not more than one brick deep at horizontal joints in Earthwool DriTherm Cavity Slab. The mortar joint should be struck flush inside the cavity and any mortar droppings must be cleaned off before the next Earthwool DriTherm Cavity Slab is fitted.



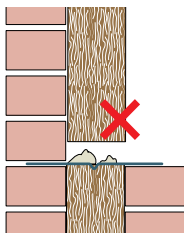
Problems to avoid



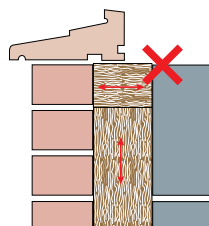
Do not push slabs into the cavity. Mortar snots may be dislodged and bridge the cavity. This can happen all too easily where a change in the leading leaf occurs and care should be exercised at such positions to ensure correct application.



Do not tear or impale Earthwool DriTherm Cavity Slab. If there are protrusions into the cavity, Earthwool DriTherm Cavity Slab should be carefully cut to fit, particularly where there are extra wall ties around openings.



Do not position Earthwool DriTherm Cavity Slab on slabs which have not been cleaned of mortar droppings.



When using small off-cuts, the face of the slabs and not the edge, shall be positioned against the wall surface.

Masonry cavity walls

Full-fill with built in glass mineral wool, extra wide cavities

Wider cavities

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With the move towards carbon zero buildings, the use of wider cavities in masonry cavity walls is likely to become much more common.

Earthwool DriTherm Cavity Slab (glass) can be installed in multiple layers to fully fill cavities up to 300mm wide. Proprietary cavity closers and folded steel lintels are widely available for cavities up to 100mm wide. For cavities over 100mm wide, the choice of proprietary products is more limited. For cavities over 150mm wide, the detailing of openings may need to be altered radically.

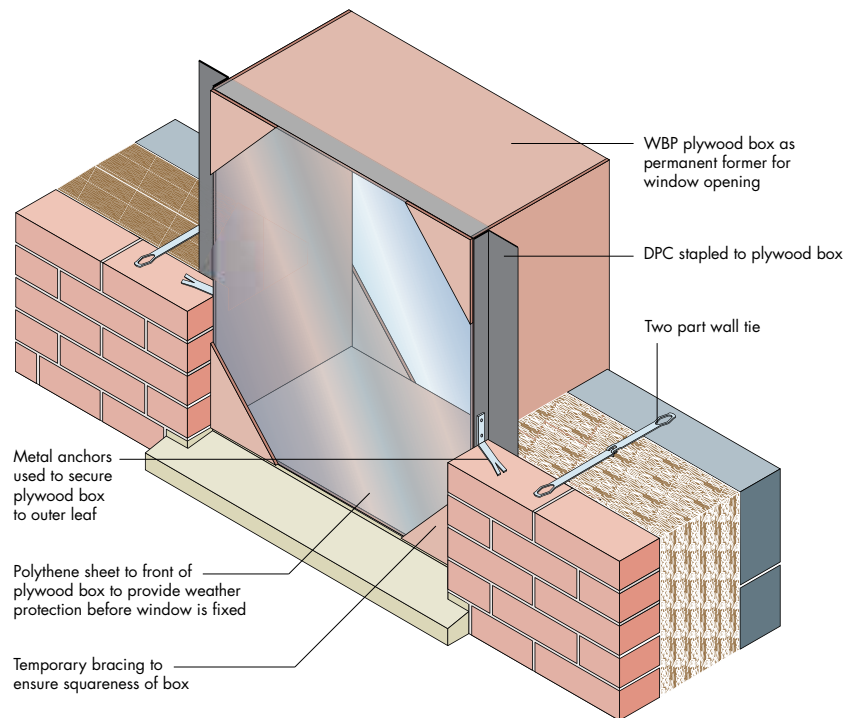
Jambs

Cavities over 150mm wide present particular problems at the jambs. One solution to this is to use a plywood liner to the opening that can also double up as a former for the window frame. The diagrams below indicate this option for a 200mm wide cavity.

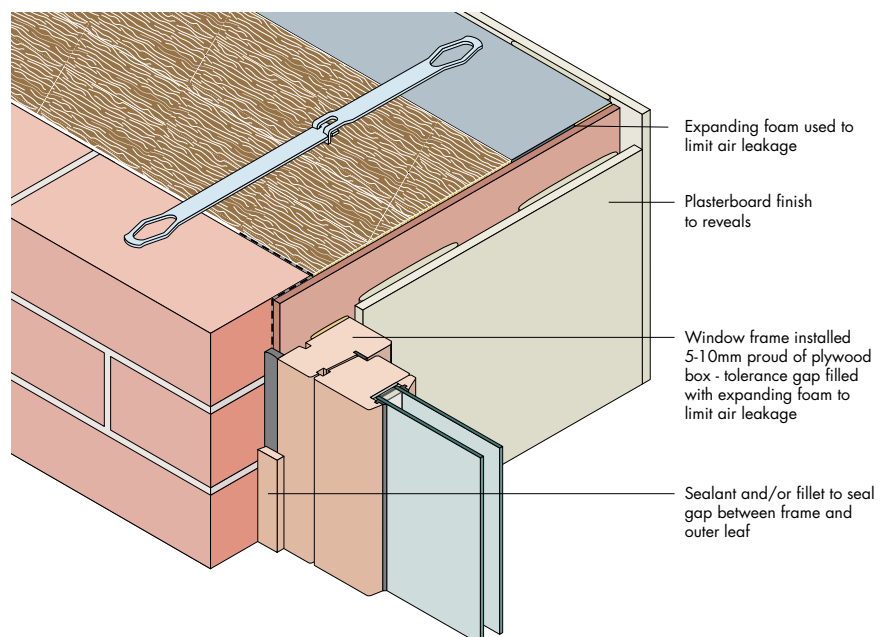
The plywood box solves a number of problems:

- It closes off the cavity
- It can be sealed against the inner and outer leaf to limit air leakage
- It provides an accurate template for the window frame
- The temporary polythene front cover provides weather protection until the window frame is installed
- The window frames can be installed after the brickwork is complete – reducing the risk of damage from mortar, etc.

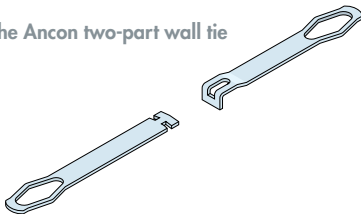
Typical use of a plywood box as former for window opening



Eaves detail showing installation of window frame in ply box



The Ancon two-part wall tie



Lintels

The use of separate lintels for the inner and outer leaf becomes more common and practical as the cavity width increases. Separate lintels not only avoid the thermal bridging problems of one piece steel lintels, but they also provide the designer with a greater level of design freedom. A concrete or aircrete lintel for the inner leaf is a simple, economic and firesafe option.

The lintel in the outer leaf can be anything from reconstituted stone to plain brickwork supported on a steel angle.

Wall ties

Earthwool DriTherm Cavity Slab is supplied in 1200 x 455mm slabs for use between wall ties at 450mm vertical centres. For cavities up to 175mm wide, stainless steel wire ties are recommended by Knauf Insulation because:

- Stainless steel has a thermal conductivity of 17 W/mK, compared with 50 W/mK for mild steel
- Wire ties have a much smaller cross-sectional area than flat metal ties

For these two reasons, stainless steel wire ties present a smaller thermal bridge through the cavity insulation than other types of metal wall tie.

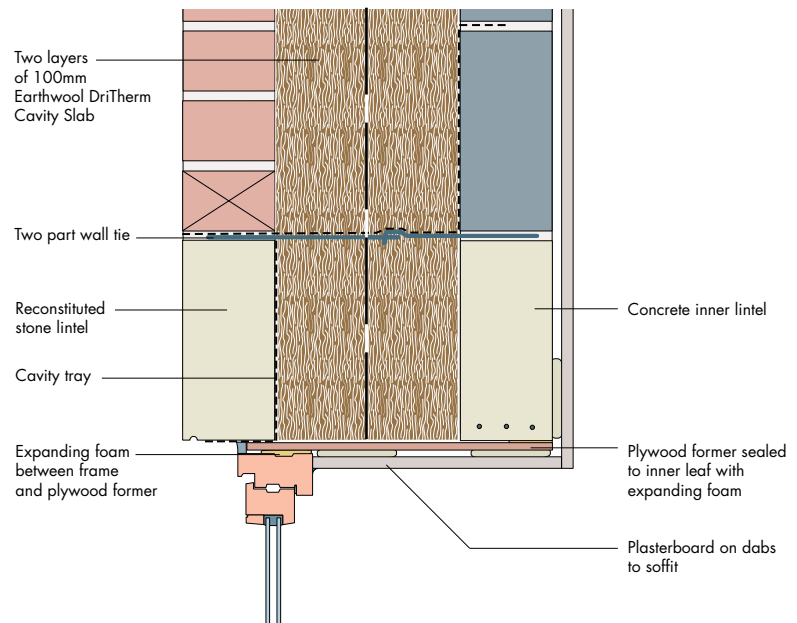
For cavities up to 175mm wide, double triangle stainless steel wire ties are available up to 300mm long.

These ties conform to BS EN 845 -1 : 2003 as a Type 3 tie. It is recommended that they are embedded 85mm into the inner leaf to help keep the cantilevered section of the tie horizontal during the build.

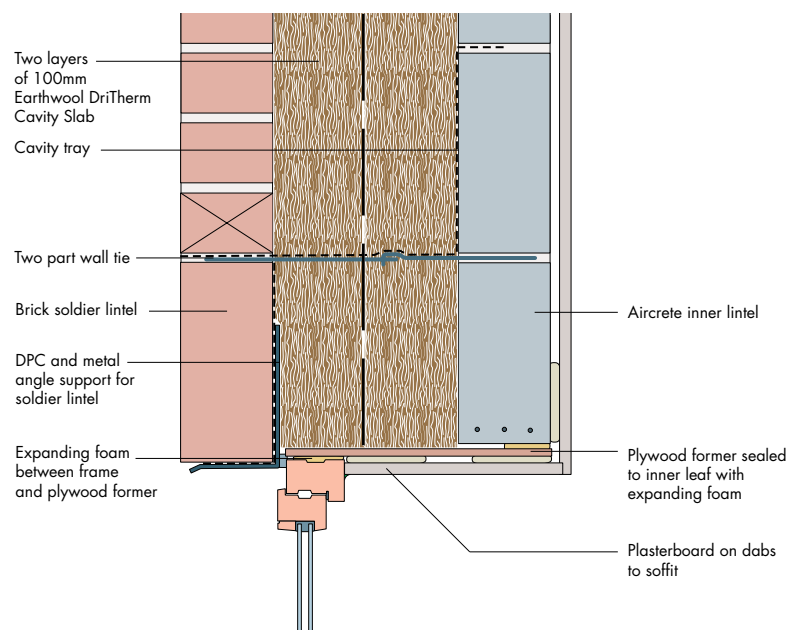
With the use of wider cavities, it is anticipated that other designs of stainless steel wire ties will be developed for cavities up to 175mm wide.

For cavities over 175mm wide, Knauf Insulation recommend the use of two part stainless steel ties. These ties overcome the problem of keeping a long tie horizontal when built into the inner leaf. However, they have a much greater cross-sectional area than wire ties and their thermal bridging effect must be taken into account when calculating the wall U-value. They are suitable for cavities up to 300mm wide.

Typical detail using separate lintels



Typical detail using separate lintels and rebated window frame



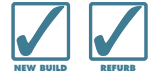
Masonry cavity walls

Full-fill with injected glass mineral wool

Supafil



Supafil



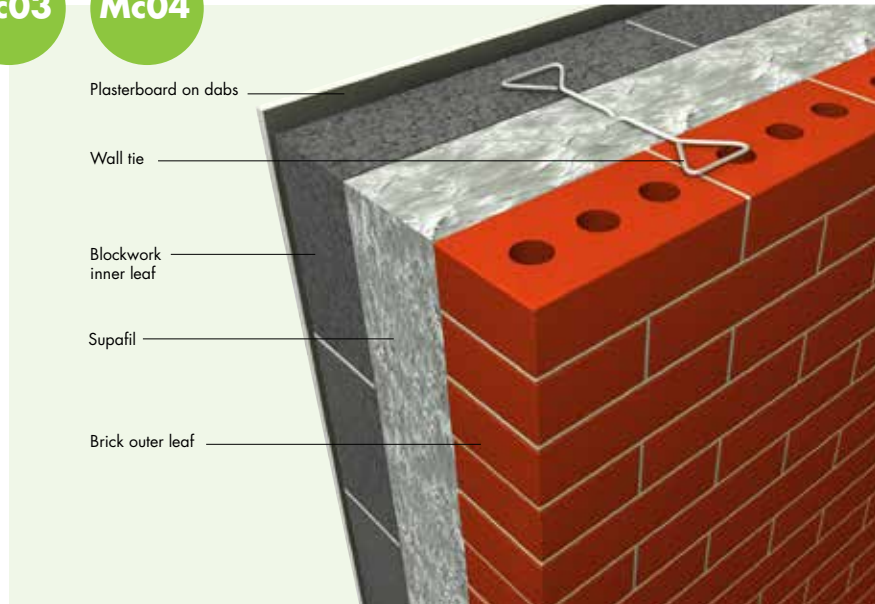
Mc03

Mc04

- Installed by trained and approved technicians, monitored by the BBA
- In-situ installation ensures intimate contact with both leaves of cavity wall preventing air movement and infiltration
- Cavity is fully filled and delivers optimum thermal performance at low cost

Supafil

- BBA Certified for all exposure zones
- Non-combustible Euroclass A1 reaction to fire rating
- A+ Generic BRE Green Guide rating
- Zero Ozone Depletion Potential (ODP)
- Zero Global Warming Potential (GWP)



Products

Supafil 34 and 40 are loose glass mineral wool insulation materials which are injected into existing or newly built masonry cavity walls. They require no mixing on site and are dry when installed, adding no water to the building.

Supafil 34 and 40 cavity wall insulation is available only through approved installers fully trained by Knauf Insulation and approved by the British Board of Agrément (BBA). A list of approved installers is available on request.

Typical construction

Brick or block outer leaf (which may be rendered), cavity fully filled with Supafil 34 and 40 cavity wall insulation, brick or block inner leaf. Internal finish of 12.50mm standard plasterboard on dabs.

Tests by the BBA confirm that Supafil 34 and 40 cavity wall insulation will not transmit water to the inner leaf. Nor will they transmit moisture by capillary action across the cavity or from below damp proof course level.

Supafil 34 and 40 cavity wall insulation have negligible water vapour resistance, allowing water vapour to pass freely through them.

Guarantee

Knauf Insulation offers a 10 year comprehensive guarantee for new build installations which covers materials and workmanship. For installation in existing domestic properties, the Cavity Insulation Guarantee Agency (CIGA) offers a 10 year guarantee covering both materials and workmanship.

Installation

A survey is carried out prior to installation to ascertain the suitability of the building for insulation and to determine the position of flues and air vents, etc. Essential ventilation openings such as those providing combustion air or under floor ventilation, and all flues in the cavity wall, are checked and sleeved, or otherwise modified to prevent blockage by the insulation.

An approved cavity barrier is inserted as appropriate to isolate terraced or semi-detached properties and to close any open cavities.

A series of holes are drilled in accordance with the patterns detailed by the BBA Certificates. For new build schemes, the holes are usually drilled through the inner leaf and the insulation installed prior to plastering. For existing buildings, holes are usually drilled through the mortar joints in the outer leaf and are made good by re-pointing with mortar to match the wall finish as closely as possible.

Supafil 34 and 40 cavity wall insulation is fed into an approved blowing machine and injected into the cavity under air pressure through a flexible hose fitted with a tapered nozzle.

The machine is fitted with a pressure sensor which automatically cuts off to stop the flow of material when the area of wall being insulated is completely filled to the correct density.

Specialised buildings

Knauf Insulation together with their approved installers have considerable knowledge and practical experience of installing Supafil cavity wall insulation in various constructions such as: Cornish, BISF and other system-built houses. Knauf Insulation will be pleased to advise on the compatibility of any building and its suitability for insulating with Supafil products.

Performance

Supafil 34 and 40 cavity wall insulation will not deteriorate with age or settle, and will therefore remain effective for the life of the building.

The operations of all approved installers are rigidly monitored by Knauf Insulation and the BBA in accordance with the terms of the BBA Certificates.

Thermal performance

Supafil 34 cavity wall insulation has a thermal conductivity of 0.034 W/mK.

Supafil 40 cavity wall insulation has a thermal conductivity of 0.040 W/mK.

Fire performance

Supafil 34 and 40 cavity wall insulation are classified as Euroclass A1 to BS EN 13501-1. The installation of Supafil cavity wall insulation will not adversely affect the fire rating of the wall and will not constitute a toxic hazard in fire conditions.



Installed by approved installing technicians

Typical U-values for fully filled masonry cavity walls - new build

U-values (W/m²K) for brick outer leaf/cavity/100mm block inner leaf, type:

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Product	Medium block (λ - 0.45)	High strength aircrete (λ - 0.19)	Standard aircrete (λ - 0.15)	Lightweight aircrete (λ - 0.11)
Supafil 34				
300	0.11	0.10	0.10	0.10
250	0.12	0.12	0.12	0.12
200	0.15	0.15	0.14	0.14
180	0.17	0.16	0.16	0.15
160	0.19	0.18	0.17	0.17
140	0.21	0.20	0.19	0.19
120	0.24	0.22	0.22	0.21
100	0.28	0.26	0.25	0.24
90	0.30	0.28	0.27	0.26
Supafil 40				
300	0.12	0.12	0.12	0.11
250	0.14	0.14	0.14	0.13
200	0.18	0.17	0.17	0.16
180	0.19	0.18	0.18	0.17
160	0.21	0.20	0.20	0.19
140	0.24	0.23	0.22	0.21
120	0.27	0.25	0.25	0.24
100	0.31	0.29	0.28	0.27
90	0.34	0.31	0.30	0.29



Note: The U-values have been calculated assuming that all walls are lined with 12.50mm standard plasterboard on dabs on standard blocks with 10mm mortar joints. Wall ties assumed to be stainless steel at 2.5 per m² with a cross-sectional area of no more than 12.5mm² for structural cavities up to 175mm wide. For cavities above 175mm, the cross sectional area of wall ties is assumed to be 25mm². Air gap correction level is zero. Multiple layers are required for several of the solutions detailed above.

Typical U-values for fully filled masonry cavity walls - existing

U-values (W/m²K) for brick outer leaf/cavity/100mm block inner leaf, type:

Mc04

Product	Brick (λ - 0.56)	Block (λ - 1.13)	Block (λ - 0.51)	Block (λ - 0.34)
Supafil 34				
100	0.28	0.28	0.28	0.27
85	0.32	0.33	0.32	0.31
75	0.35	0.36	0.35	0.34
65	0.39	0.40	0.39	0.37
50	0.47	0.49	0.47	0.45
Supafil 40				
100	0.32	0.33	0.32	0.31
85	0.36	0.37	0.36	0.35
75	0.40	0.41	0.39	0.38
65	0.44	0.46	0.44	0.42
50	0.52	0.55	0.52	0.50



Note: The U-values have been calculated assuming that all walls are lined with 12.50mm standard plasterboard on dabs on standard blocks with 10mm mortar joints. Wall ties assumed to be stainless steel at 2.5 per m² with a cross-sectional area of no more than 12.5mm² for structural cavities up to 175mm wide. For cavities above 175mm, the cross sectional area of wall ties is assumed to be 25mm². Air gap correction level is zero. Multiple layers are required for several of the solutions detailed above.

Typical specification

Supafil 34*/40*/ glass mineral wool cavity wall insulation to be injected into the cavity by an Knauf Insulation/BBA Approved Installer. (*Delete as appropriate)

New cavity walls to receive Supafil 34*/40* cavity wall insulation by injecting insulation into the cavity should be constructed so that insulation cannot penetrate ventilation ducts or pass through to cavities in adjoining buildings or compartments which are not to be insulated. Close fitting ducts or sleeves should be installed across the cavity to serve air bricks and other ventilation openings. Cavity barriers should be installed at junctions with other properties and compartments, and as required by the Building Regulations.

Existing cavity walls to be inspected by the approved installer and all necessary builder's work carried out prior to Supafil 40* cavity wall insulation being injected.

All work to be in strict accordance with the procedures laid out in the relevant BBA Certificate and the Knauf Insulation "Operators" and "Survey and Assessment" manuals.



Alternatively, consult the National Building Specifications, Standard version clause/clauses...P11/40 and 220.....

Knauf Insulation specification clauses can be downloaded from knaufinsulation.co.uk/nbs