external walls – timber frame

sole plates

The moisture content of structural timber should not exceed 20% at the time of stress grading and at the time of erection. All structural timber for use within the building fabric should be stress graded marked 'KD' (Kiln Dry) or 'DRY'.

Where elements are designed as stressed skin panels, notching, drilling and other perforations through the stressed skin should be designed by an Expert.

All timber elements should be fixed with durable fixings or otherwise restrained in a manner capable of resisting excessive movement caused by drying out.

Workmanship should comply with BS 8000:5.

Once timber frames have been erected, it essential that the cladding and roof covering is installed as soon as possible. In no circumstances should the timber frame be left exposed for a period greater than specified by the manufacturers of either the frame or the breather membrane.

Setting out

It is essential that the accuracy of setting out of the foundations is checked well in advance of delivery of materials to site. Design changes should be approved by the designer.

Ensure sole plates are properly located and fixed to the substructure.

The sole plates or the lowermost timber plate should be set level, accurately set out, and fixed as specified in the design.

Deviation in level should not be greater than 10 mm per 5m run.

Sole plates should not overhang the substructure by more than 12 mm, nor be set back from the edge of the substructure forming a ledge for mortar and debris to collect. Should a ledge be unavoidable then install a damp-proof tray.

Packings where necessary should:

- Be non-compressible
- Be durable and corrosion resistant
- Not exceed 20 mm
- Be as wide as the timber frame
- Be located below the vertical studs positions

Sole plates with dpc under should be mechanically fixed to the substructure masonry. Holding down anchors, straps or shoes to be of either stainless steel, phosphor bronze, silcon bronze or galvanized mild steel (940 g/m^2) at suitable centres. Mechanical fixing points are to be as specified in the design.

It is preferable to use straps or shoes, but where specified care should taken with shot fixings not to damage the supporting masonry or split timber members.

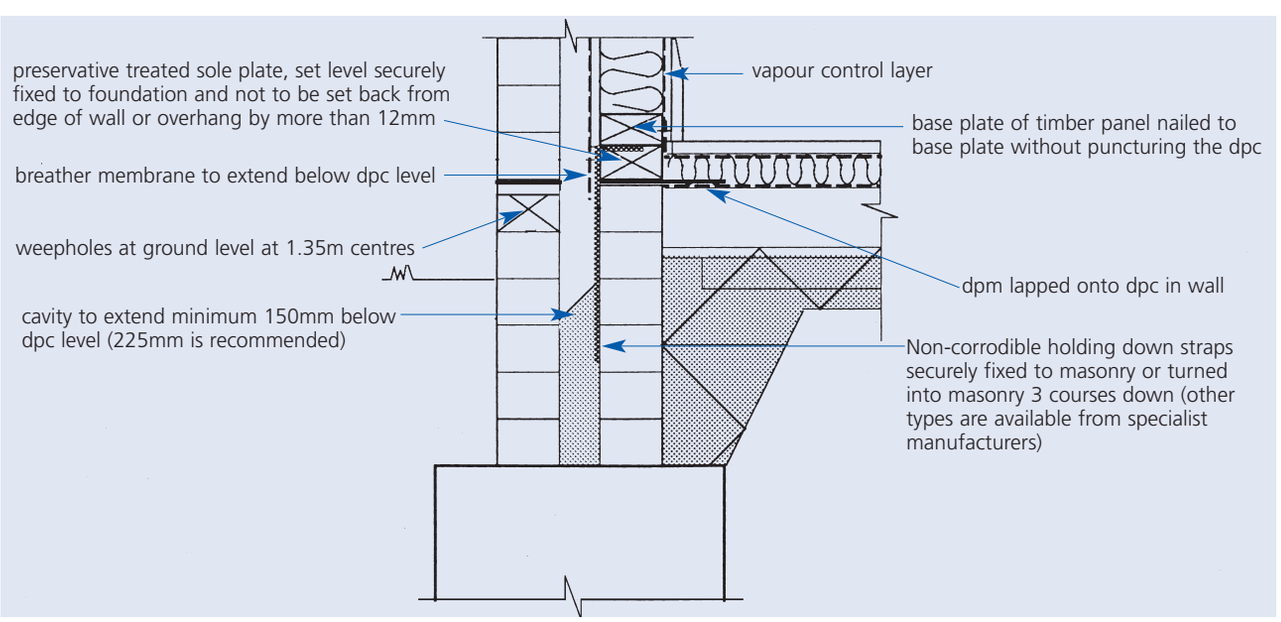

diagram 2.75: timber frame, typical ground floor detail

external walls – timber frame

timber frame

Sole plates should not be fixed to infill blocks of proprietary masonry flooring systems i.e. block and beam floors. Suitable anchoring straps must be fixed to the substructure masonry to provide adequate fixings.

With masonry, special density nailable blockwork is required and generally with concrete the fixings should not be closer than 75mm from the edge of the slab.

ZOOM IN

Protect sole plates from damp

Sole plates should be CCA preservative treated and laid on a dpc which is lapped onto the slab dpm. Wall panels should be skew-nailed to sole plates without perforating the dpc.

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Breather membrane should extend over the sole plate (See diagram 2.75).

ZOOM OUT

It is recommended that the inner leaf dpc is turned up approximately 30mm above screed to protect sole plate and bottom rails from construction moisture and spillage.

Cavity fill should be ST1 concrete and terminate no closer than 150mm below the dpc (See diagram 2.75).

Drain cavities below dpc level at 1.35m centres. eg. open perpend mortar joints.

Timber stud framework

Avoid the following defects:

- Gaps between panels and nails missing at panel to panel connection
- Bottom rails not securely fixed to sole plates
- Plates, rails and studs cut away for services and holes drilled for electrical services near edge of stud
- Use of damaged wall panels
- Upper-deck wall panels nailed to floor decking only and not to joists
- Inadequate packing under upper storey panels
- Studs out of plumb
- Studs missing or overloaded
- Split timbers caused by nailing too close to edge of timber

Materials and fixings

Timber elements should be regularised, bear a stress grade stamp and the moisture content should not exceed 20% at time of erection. All structural timber to be used within dwellings must be clearly marked ‘DRY’ or ‘KD’.

The moisture content of timber can be checked by the use of an electrical resistance moisture meter. The type with insulated probes is recommended which can be driven into the timber.

Timbers forming part of the external timber frame should be treated, see table 2.10.

Timber element	Process
Timber studs and rails, header joists, lintels and binders, cavity barriers and sole plates above screed level, including any timber or plywood packing pieces.	CCA vacuum/pressure, O/S double vacuum, or Boron diffusion.
Sole plates below screed level.	CCA vacuum/pressure.

table 2.10: treatment of external timber frame

Where elements are designed as stressed skin panels, notching, drilling and other perforations through the stressed skin should be designed by an Expert.

All timber elements should be fixed with durable fixings or otherwise restrained in a manner capable of resisting excessive movement caused by drying out.

Workmanship should comply with BS 8000:5.

Framed walls should be accurately aligned, plumb, level, without twist and securely fixed to adjacent elements using durable fixings suited to the location of the element.

Bedding under frames to accommodate variations in level should be made with a durable non-compressible material of full frame width. The maximum depth of the bedding should not exceed 20mm.

external walls – timber frame

timber frame

Unless designed by an Expert, holes for electrical services may only be drilled on the centre line of timber studs between 0.25 and 0.40 of height. Maximum hole size is 0.25 of stud depth (See diagram 2.76). Timber studs should not be notched.

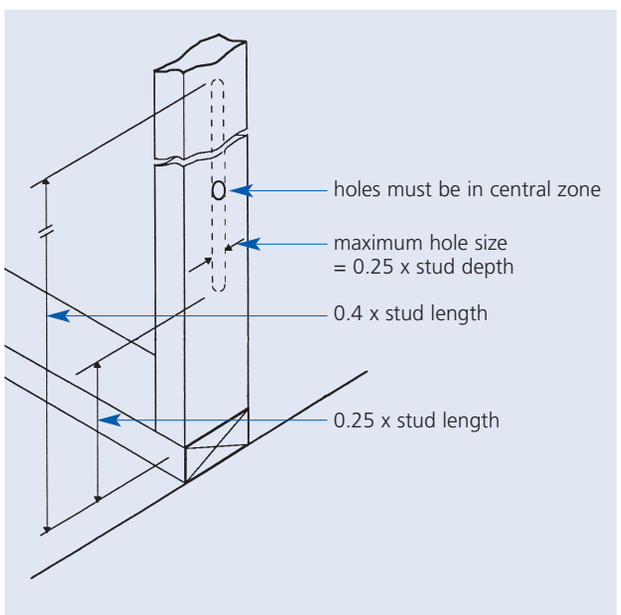

diagram 2.76: holes in studs or posts

Standard Durability Sheathings
• Canadian Douglas fir and softwood plywoods, Finnish conifer plywood and Swedish softwood plywood as specified in BS 5268:2, which meet the BS 5268:6 requirements for plywood sheathing and have a WBP (weather and boil proof) bond as specified in BS EN 314 & 636. In addition, plywoods constructed throughout of softwood, which meet the BS 5268:6.1 requirements for plywood sheathing and have a WBP bond as specified in BS EN 314 & 636.
• Impregnated softboard type SBS which meets the requirements specified for sheathing in BS EN 622.
• High-density medium board type HME which meets the requirements specified for sheathing in BS EN 622.
• Wood chipboard of moisture-resistant types P5, P6 and P7 which meet the requirements specified for sheathing in BS EN 312.
• Oriented Strand Board (OSB) type OSB/3 and OSB/4 which meets the requirements specified in EN 300 and at least 8mm thick.
• Any board (treated or untreated) that has been certified by independent third party certificates acceptable to Zurich Insurance Building Guarantees. as suitable for sheathing according to MOAT 26.
• Any board included in table 2.12
Note : * These sheathings have a high moisture vapour resistance and designers should check that there is no risk of interstitial condensation in accordance with BS 5250.

table 2.11: standard durability sheathings

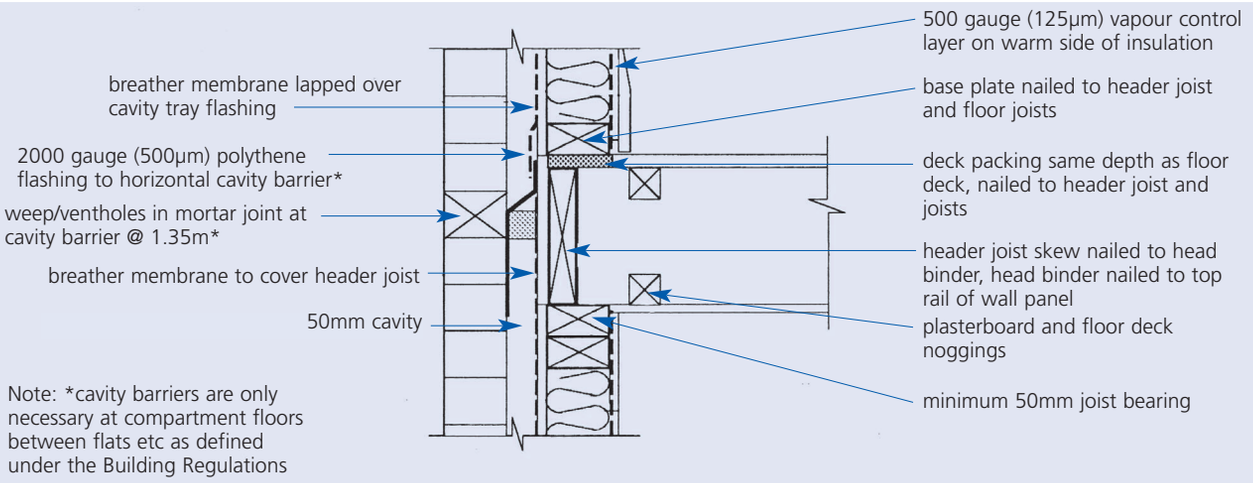

diagram 2.77: timber frame, first floor detail

external walls – timber frame

timber frame

ZOOM IN

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Sheathing

Sheathing is usually provided to timber framed walls to provide increased strength to the structure or simply to protect the building from the elements prior to fixing the external cladding. Where sheathing provides racking resistance to wind and other lateral loads, the edge distance and spacing of the fixings are critical.

When fixed on site, sheathing should be nailed to stud members with galvanised, sherardised, stainless steel, phosphor or silicon bronze nails at centres as the approved design. Nails must not be overdriven.

Sheathing should achieve standard durability level and be of the type shown in table 2.11.

Sheathings for dwellings that are subject to extreme exposure conditions on sites located in areas defined as 'very severely exposed' (see map on page 151) should use either improved protection of standard durability see (1) in table 2.12, or alternatively, an enhanced level of sheathing durability, see (2) in table 2.12. Such dwellings would not be sheltered by local features, including surrounding buildings and trees, and therefore would not qualify for the reductions of exposure category permitted.

1 Improved protection of the sheathing using either:	2 An enhanced level of sheathing durability using the following:
• high performance breather membranes as specified in the TRADA Wood Information Section 1, Sheet 35. • a 50mm cavity wall with a rendered finish or with cladding of metal, plastics, slate, tile hanging, timber boarding or similar materials.	• Tempered hardboard* type THE which meets the requirements specified for sheathing in BS EN 622 (also defined as type TE in BS 5268:6.1) • Cement-bonded particleboard* which meets the requirements specified for sheathing in BS EN 634:2. • Plywood that has been treated with a minimum of ten minutes dip in an organic solvent preservative complying with type F/N of BS 5707:1, or plywood treated with any of the preservatives complying with BS 5589: section 8 clause 63 so that the outer veneers are completely penetrated. In addition the plywood should meet the requirements for sheathing specified in BS 5268:6 and have a WBP bond as specified in BS EN 314 & 636. • Any board (treated or untreated) that has been certified by BBA as suitable for sheathing according to MOAT 26, and which in the associated BS 1982:1 test has a durability at least equivalent to a plywood manufactured entirely from moderately durable timber.

Note * These sheathings have a high moisture vapour resistance and designers should check that there is no risk of interstitial condensation in accordance with BS 5250.

table 2.12: sheathing for very severely exposed sites

external walls – timber frame

timber frame

ZOOM IN

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Breather Membrane

Avoid the following defects:

- Breather membrane torn at service entrance points
- Laps too small
- Breather membrane damaged by site work or wind
- Laps in breather membrane in wrong direction allowing ingress of water
- Breather membrane not extended to protect sole plate
- Marker tapes, or identification marks, for stud locations inaccurate or absent
- Breather membrane not lapped over lintels.

Suitable breather membranes

Breather membranes are normally provided to the face of sheathing as an additional waterproof barrier in cases where rainwater entering the cavity can come in contact with the timber frame construction (See diagram 2.77).

Suitable breather membranes can be identified by reference to BS 4016 noted on each roll and TRADA publication TBL 64: Test methods for breather membranes for timber frame walls. It should be noted that in areas designated as 'very severe', only 'high performance' breather membranes can be used. **Impervious roofing felts are not suitable as breather membranes.**

Where no breather membrane is required (eg, where bitumen impregnated fibreboard is used) the joints between sheets should be taped to prevent draughts.

Fixing of breather membranes

Breather membranes are normally fixed with stainless steel staples and should be continuous, lap onto cavity trays and extend below sole plates and dpcs (See diagram 2.60).

Laps should be minimum 100mm horizontal and 150mm vertical (See diagram 2.78).

Breather membrane should be fixed in horizontal bands starting at the bottom of the building and working up so that upper layer overlaps the lower layer (See table 2.13).

Repair any damage to breather membrane before fixing of cladding (See diagram 2.79).

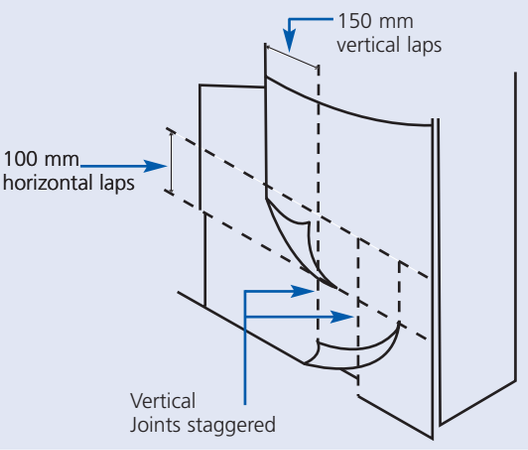


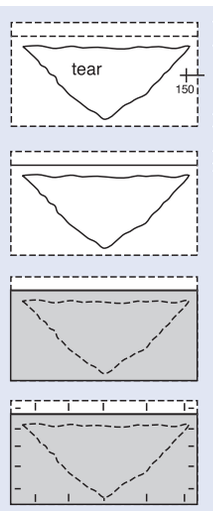
diagram 2.78: lapping breather membranes.

Fixing of breather membranes

	Fixing centres (mm)
Vertical	
at stud position	300
at sides of opening	150
at vertical membrane joints	150
at end of panel*	150
Horizontal	
at eaves	300
at sole plate or bottom rail	150
at horizontal membrane joint	150
at head and base of openings	150
at head and base of panels`*	

* required when membrane is fixed to panels in the factory

table 2.13: fixing of breather membranes.



CUT PATCH minimum lap over tear as shown

CUT SLIT ABOVE TEAR no wider than patch

TUCK TOP OF PATCH INTO SLIT

STAPLE PATCH with stainless steel staples

Damaged membrane must be repaired at the earliest opportunity. It is essential before any internal finishes are applied. Check regularly that damage has not occurred during construction after initial completion and repair as and when necessary. Patching must be carried out tidily, dressing top edge under existing membrane as shown.

Under NO circumstances are patches simply to be applied without dressing under as water running down the face of the building will find its way behind them.

diagram 2.79: repairing breather membranes.

external walls – timber frame

thermal insulation

ZOOM IN

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ZOOM OUT

Avoid the following defects:

- Thermal insulation quilt missing
- Thermal insulation not continuous above lintels and at junctions with other walls
- Paper backing on thermal insulation not stapled to studs
- Sagging thermal insulation (cold bridges)
- Thermal insulation squashed (reduced efficiency)

Fixing of thermal insulation

Generally flexible quilts should be mechanically fixed between studs to avoid sagging (eg, by stapling).

Particular attention is required to avoid cold bridges at internal/external wall junctions where it is difficult to fix insulation between closely spaced studs.

Insulation should extend down to floor insulation (or provide perimeter insulation to slab edge).

Vapour control

Avoid the following defects:

- Vapour control layer with gaps at joints
- Holes in vapour check plasterboard and tears in polythene vapour control layer

Suitable vapour control layers

Suitable vapour control layers include 500gauge (125µm) sheet polythene (manufactured from virgin polymer) or metalised polyester backed plasterboard (not foil backed plasterboard). Sheet polythene is preferred to plasterboard due to the problem of sealing board joints.

Where metalised polyester backed plasterboard is used as a vapour control layer, it should be fixed in strict accordance with the manufacturer's instructions, in particular ensuring that joints occur at studs and noggings, and are filled and taped.

Fixing of vapour control layers

Condensation can cause timber decay and reduced efficiency of thermal insulation.

Vapour control layers should be provided to timber framed external walls on the warm side of the insulation (See diagram 2.80).

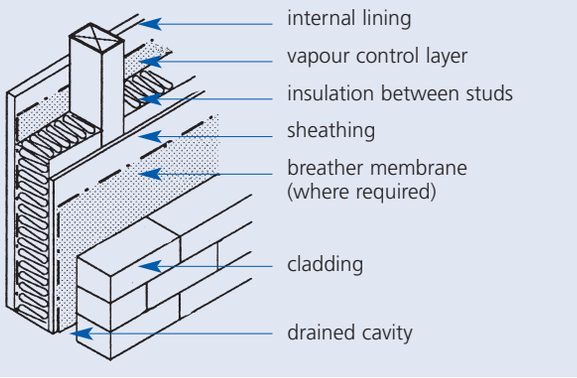
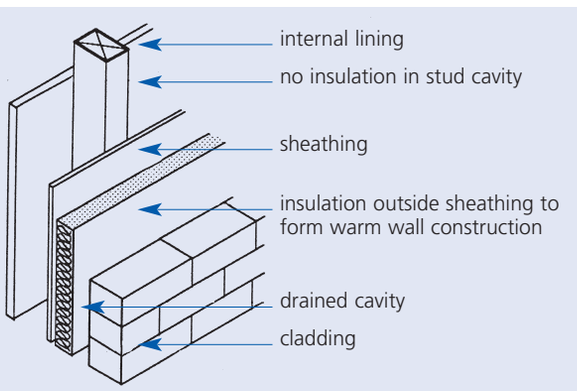


diagram 2.80: timber frame external wall construction

"Warm wall" constructions (thermal insulation located outside sheathing) normally do not require a vapour control layer. Such systems need to be approved by an independent assessment authority (See diagram 2.81).

The moisture content of the timber frame should be below 20% before the vapour control layer is fitted.

In practice it is very difficult to achieve a perfect vapour barrier and consequently a combination of vapour check and ventilation of the fabric is often used.



Note: warm wall system should be approved by an independent testing authority

diagram 2.81: timber frame warm wall construction

external walls – timber frame

vapour control

ZOOM IN

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ZOOM OUT

Venting of Cavities

It is considered unnecessary to provide weepholes to the base and head of a timber-framed building, provided an equilibrium of moisture and air within the cavity behind the external masonry cladding can be achieved.

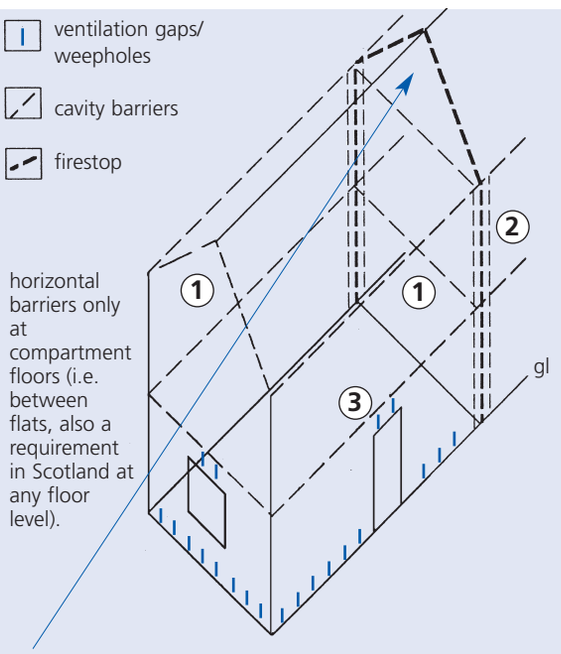
Weepholes are therefore only required at the foot of the wall, usually **at ground level,** therefore eliminating the need to vent the cavity.

The exception to the provision of one set of weepholes is where the cavity is bridged by lintels etc. in the normal way or where a fire barrier is provided at a floor level in accordance with Approved Document B, in which case weepholes are required directly above the fire break to allow any moisture entering the cavity to be readily drained away.

The use of a vent/weephole ventilator incorporating an insect resistant grille is recommended.

Cavity widths should be:

- Masonry, 50mm
- Render, 25mm when the mesh or metal lathing is backed by a breather membrane
- Render, 50mm when the mesh or metal lathing is unbacked
- Other claddings, 19mm



firestop at junction between separating wall and external walls/roof

Note: cavity barriers to be provided at:
1 verge or ceiling level
2 external/separating walls
3 external wall/compartment floors between flats

ventilation gaps/weepholes to be provided at:
– dpc level
– compartment floors and above lintels in masonry walls

Note: In Scotland provide cavity barriers at:
– a junction between any floor and an external wall
– vertical and horizontal centres not exceeding 15m
– around openings

diagram 2.82: cavity barriers and venting of cavities

external walls – timber frame

wall ties

Avoid the following defects:

- Wall ties nailed to sheathing only, instead of the studs
- Wall ties not sufficiently embedded in brickwork
- Prefixed wall ties not coinciding with masonry mortar joints
- Mortar droppings on cavity wall ties
- Wall ties sloping backwards to the internal wall
- Rigid wall ties used instead of flexible ties

ZOOM IN

Fixing of wall ties

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Wall ties should be fixed to studs with stainless steel, phosphor bronze or silicon bronze nails.

Wall ties should be flexible stainless steel or equally durable.

ZOOM OUT

Ties should be fixed to studs, not sheathing, at centres not greater than 600mm horizontally, 450mm vertically (300mm to reveals) (See diagram 2.83).

Wall ties should be embedded in mortar joints to a minimum depth of 50mm with a slight fall towards the external brickwork.

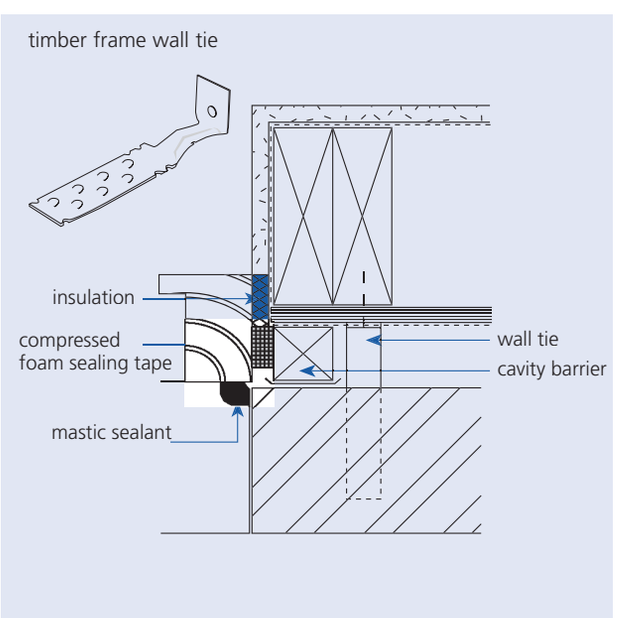

diagram 2.83: timber frame, window reveal detail.

movement control

Avoid the following defects:

- Insufficient allowance for shrinkage of timber frame relative to masonry at eaves, verges, windows and door sills
- Cracking of cladding due to absence of a movement joint between different types of cladding
- Absence of movement joint where timber or render cladding bridges intermediate floor zones
- Failure of weather-tight joint at window jambs due to shear from movement

Masonry

Ensure that differential movement between timber frame and independently supported claddings such as masonry can take place, particularly at:

- Eaves and verges (See diagram 2.84)
- Window and door sills (See diagram 2.85)

Make allowance for vertical sliding of masonry against side of openings by providing a flexible mastic joint between reveals and frames.

Where cladding horizontally abuts masonry, provide a movement joint to allow for differential movement (See diagram 2.86)

Where cladding vertically abuts masonry, provide a movement joint with drainage channel discharging onto a cavity tray dpc (See diagram 2.86).

Timber cladding

Where timber cladding spans across a floor zone, provide a movement joint to accommodate timber shrinkage (See diagram 2.87)

Cement render

Where cement render on lath fixed to the frame spans across an intermediate floor zone in timber frame construction, allow for differential movement due to timber shrinkage by incorporating a weather-tight movement joint using a proprietary render stop.

Vertical movement joints should also be provided at maximum 5m horizontal centres to render panels.

A movement gap must be maintained below any horizontal render stop bead on masonry below.

external walls – timber frame

movement control

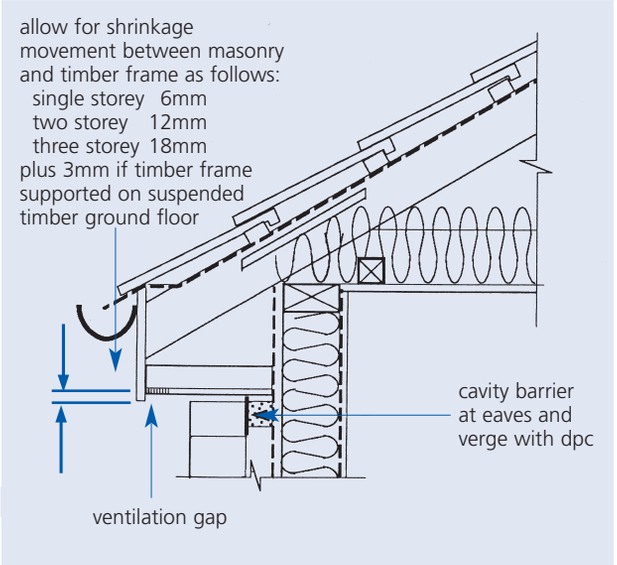

diagram 2.84: timber frame, movement control at eaves

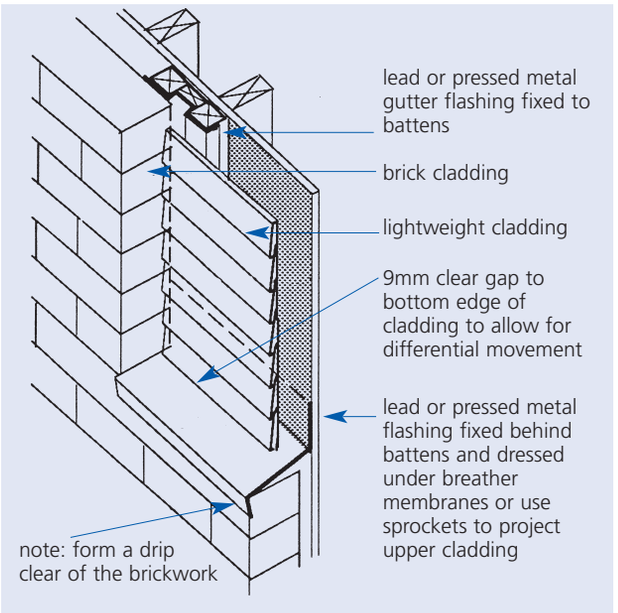

diagram 2.86: typical movement joint between different claddings at first floor level

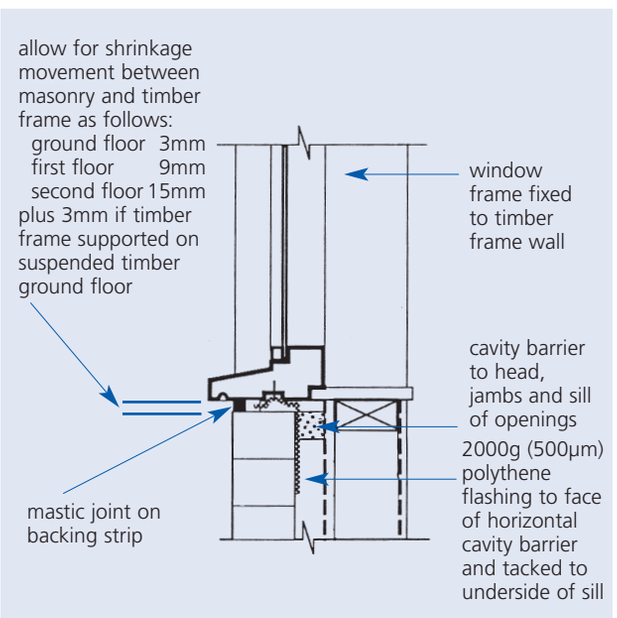

diagram 2.85: timber frame, movement control at window sill

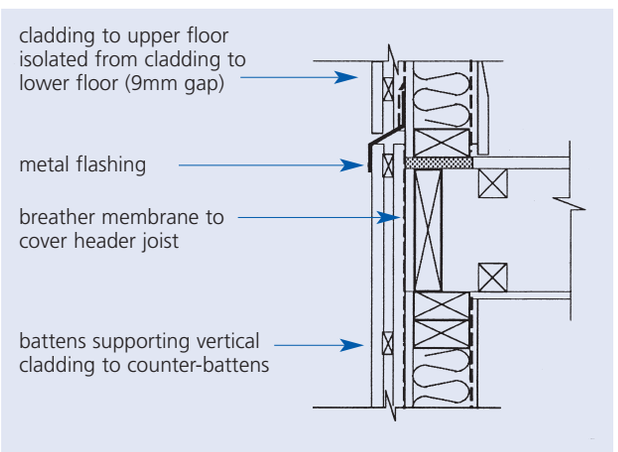

diagram 2.87: timber frame, first floor movement joint

external walls – timber frame

cladding

ZOOM IN

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Claddings fixed directly to frame

Avoid the following defects:

- Insufficient overhang of roof at verges to protect render
- Battens fixed directly to sheathing
- Mesh for render inadequately fixed to timber frame
- Mesh for render damaged or deformed
- Movement or slipping of timber cladding

Timber

Boarding to be preservative treated, minimum 16mm thick and sufficient tongues or overlaps provided to permit shrinkage and expansion of the timber.

Timber boarding should be battened off the sheathing to provide a minimum 19mm cavity for draining and venting (See diagram 2.88).

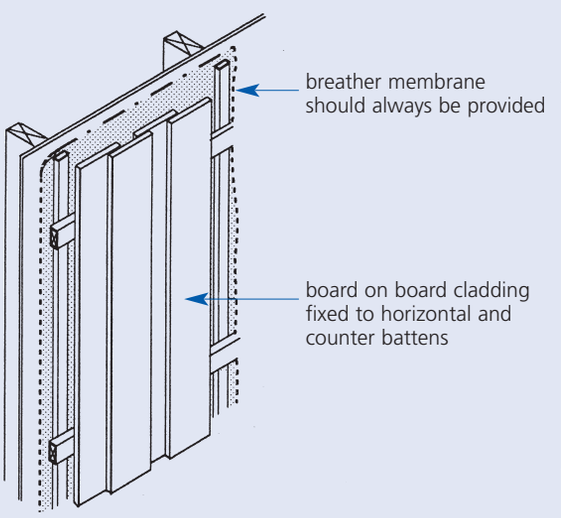

diagram 2.88: vertical timber cladding

Battens should be a minimum 38mm wide, preservative treated and at maximum 600mm centres. Battens should be fixed to each stud (and not to sheathing) with annular ring nails of length at least twice the batten thickness plus the sheathing thickness or plain nails of length at least 2.5 times the batten thickness plus the sheathing thickness. All nails to be fixed at 600mm centres.

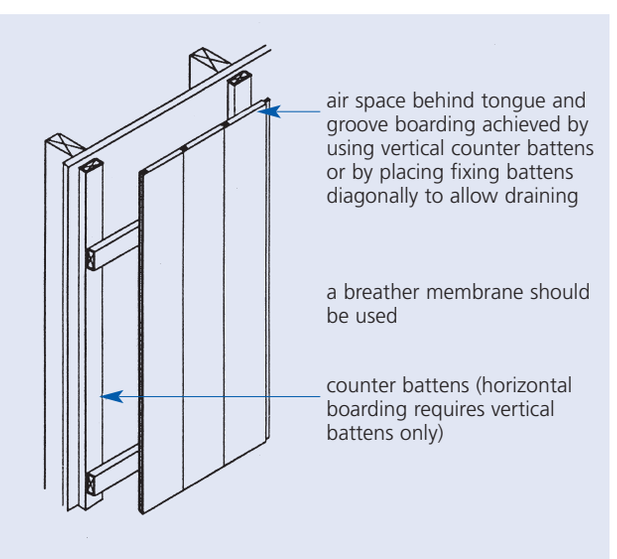

diagram 2.89: vertical timber cladding

Counter battens should be used for vertical cladding (See diagram 2.89).

Boards should be fixed to battens by face or secret nailing with annular ring nails at least twice the board thickness or plain shank nails at least 2.5 times the board thickness. Butt joints at board ends should occur at battens. Nails should be either hot dipped galvanised, stainless steel or equally durable. Aluminum nails should not be used with CCA treated timber and galvanised nails should not be used with Western Red Cedar.

Corners and reveals should be formed to provide a weather-tight construction (See diagram 2.90).

Plywood

Plywood sheets used as cladding should be pressure preservative treated, a minimum 12mm thick and bonded with WBP or equal quality exterior adhesive and marked accordingly. Battens should be vertical and treated. Joints between sheets should be made resistant to excessive water penetration by fixing cover battens or flashings. (See diagram 2.91).

external walls – timber frame

cladding

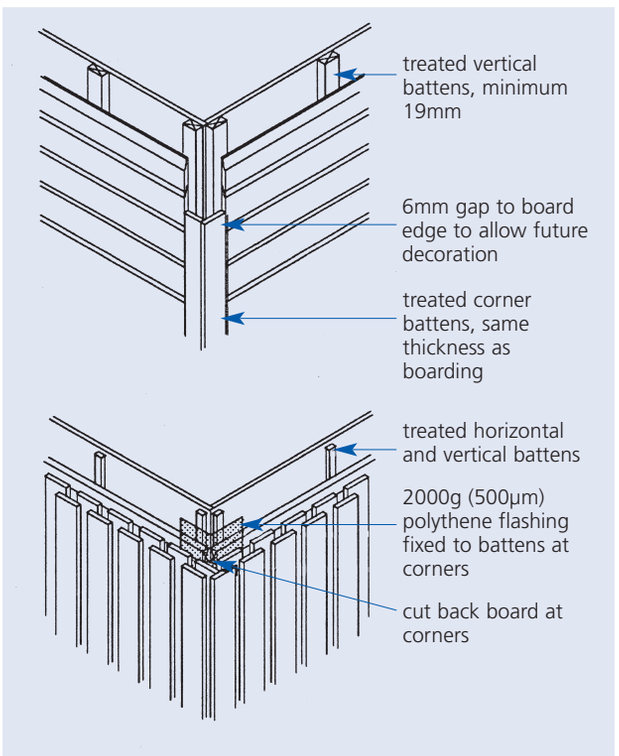

diagram 2.90: timber cladding – corner details

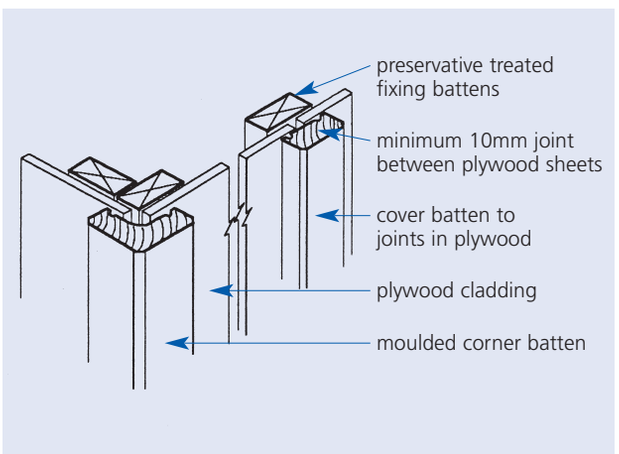

diagram 2.91: plywood cladding

Render

Battens should be either 25 x 38mm or 50 x 50mm, preservative treated.

Battens should be fixed to each stud with annular ring nails of length at least twice the batten thickness plus the sheathing thickness or plain nails of length at least 2.5 times the batten thickness plus the sheathing thickness.

Horizontal battens must be drilled or notched to maintain ventilation requirements.

Nails should be hot dipped galvanised, stainless steel or equally durable.

Mesh or metal lathing should be stainless steel or assessed by an independent authority and fixed to vertical battens at maximum 600mm centres with stainless steel staples.

Laps in the lathing should be wired together at 150mm centres.

A damp-proof course should be provided between unbacked rendered lath and timber battens.

Render should not bridge the dpc and should be finished onto a durable render stop.

Three coat work is essential, at least 16mm thick.

First and second coats should be 1:½:4 (cement : lime : sand) or 1:3 (cement : sand with plasticiser) or 1:3 (masonry cement : sand).

Final coat should be 1:1:6 (cement : lime : sand) or 1:6 (cement : sand with plasticiser) or 1:4½ (masonry cement : sand). More detailed guidance on render selection and mixes is given in tables 2.14 or 2.15 pages 187 or 188

See page 172 on movement control for location of movement joints in render.

external walls – timber frame

cladding

Tile and slate cladding

Tile or slate cladding should be fixed in accordance with the manufacturer's recommendations.

Battens should be a minimum 38 x 25mm for stud centres up to 600mm, and should be preservative treated. 38 x 19mm counterbattens should be provided on severely exposed sites. Severely exposed sites are those shown on the wind driven exposure map contained on page 151.

Battens should be level and fixed to each stud (not to sheathing) with annular ring nails of length at least twice the batten thickness plus sheathing thickness or plain nails of length at least 2.5 times the batten thickness plus the sheathing thickness.

Battens should not normally be less than 1200mm in length and span across at least 3 supports.

Nails should be either hot dipped galvanised, stainless steel or equally durable.

A breather membrane (not a roof underlay) should normally be fixed to the sheathing behind the battens.

Edge of hanging tiles should be cloaked at the jambs of all openings with purpose made corner tiles or by butting against a timber reveal with drainage channel behind.

Other claddings

Other cladding should only be used if they either:

- Conform with a British Standard and, where appropriate, are detailed for use with timber frame construction by the manufacturer
- Approved as being suitable by an independent assessment authority
- In addition they should be approved by Zurich Insurance Building Guarantees

Installation of services

Avoid the following defects:

- Insecurely fixed socket outlets, switches, cooker point boxes, etc
- Electric power cables not derated where they run in or besides thermal insulation
- Loadbearing studs cut away to accommodate meter boxes, flues, etc
- Holes in vapour barriers around service pipes not sealed
- Timber damaged by plumber's blow torch.
- Metal sleeves not provided to flues.
- External and internal load bearing studs drilled or notched excessively

Cables running in, or covered by, thermal insulation should be derated to reduce the risk of overheating. The current carrying capacity should be reduced by 50% when the cable is fully surrounded or by 25% when the insulation is on one side.

Provide noggings to support heavy fixtures and fittings.

Holes in vapour control layers for services should be cut close and neat and sealed around the pipe or cable.

Provide fire protection around flue pipes (eg. metal sleeve extending through the wall thickness and a 25mm air gap between the pipe and sleeve).

Plumbing runs should not be located in external walls to avoid inaccessibility and the risk of condensation occurring on the pipes.

Holes in studs for services should be sized and positioned in accordance with diagram 2.76 page 167.

Compatibility of fixings

Structural timber in timber framed walls and cavity barriers should be preservative treated.

When Copper Chrome Arsenic (CCA) treated timber is used, aluminium fixings should not be used.

In order to avoid corrosion of ferrous fixings, timber treated with water borne preservative should not be fixed until the timber has dried out to its required moisture content.