

Good Craftsmanship Guide

Brickwork and Blockwork



Introduction

This Good Craftsmanship Guide highlights key problems with brickwork and blockwork and gives guidance on how to avoid them. The problems are those most commonly identified during NHBC's inspection of homes under construction. All photographs are of defects and were taken on real building sites.

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Substructure

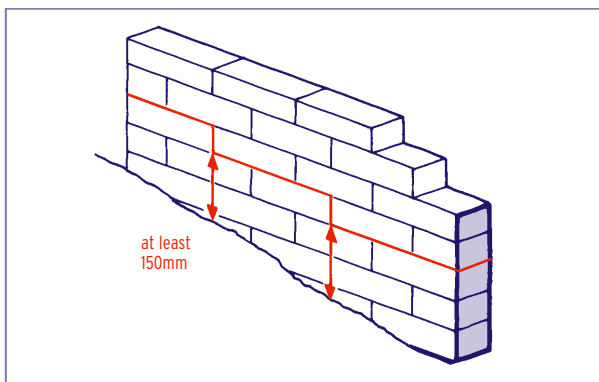
Problem to avoid:

- Rising damp

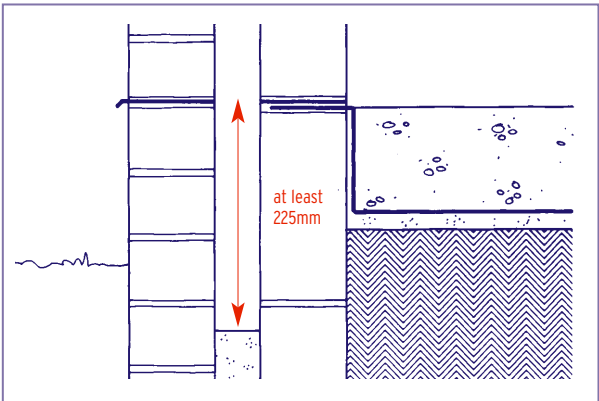


What to do:

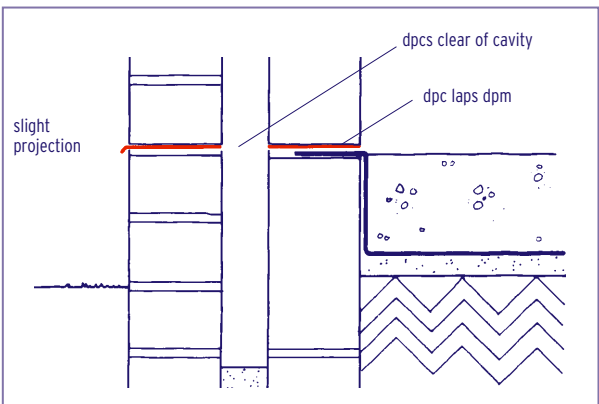
- locate dpc at least 150mm above external ground or paving level



- | | | |
|--|--|--|
| | | |
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- use the correct width dpc
- do not allow dpc to project into cavity - it could catch mortar and debris
- lap dpc with dpm of floor slab



Cavities

Problems to avoid:

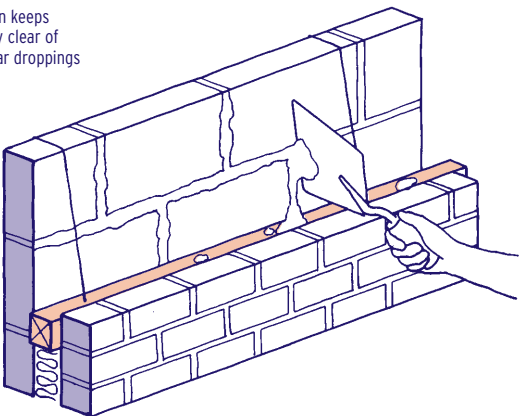
- Water crossing the cavity



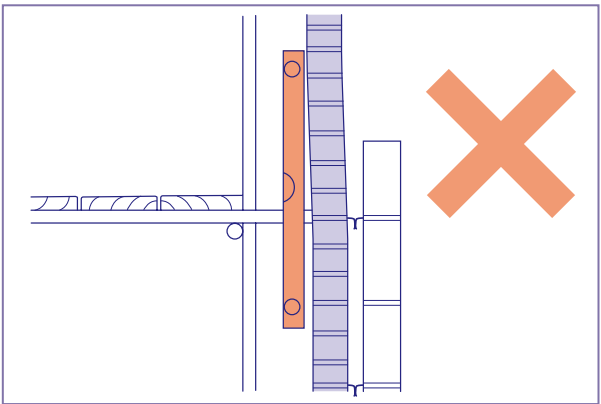
What to do:

- keep cavities uniform and to the width specified in the design - at least 50mm
- strike mortar off all joints as work proceeds
- keep cavities clear of droppings and debris

batten keeps
cavity clear of
mortar droppings



- limit the height difference between the two leaves of a cavity wall under construction - never more than 6 standard block courses
- do not over reach - wait for the next scaffolding lift



Wall ties

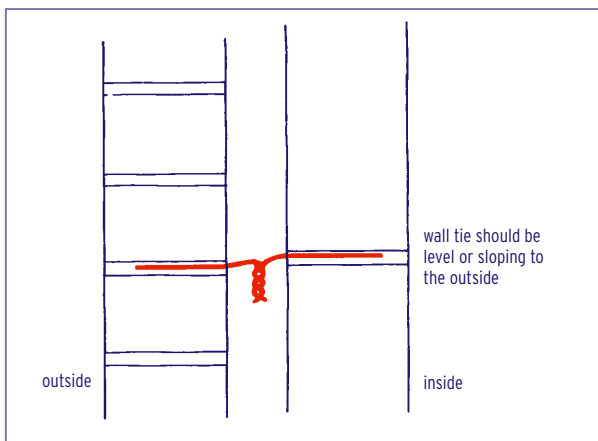
Problems to avoid:

- Leaves of wall not tied together adequately
- Water crossing the cavity on wall ties
- Incorrect wall ties used

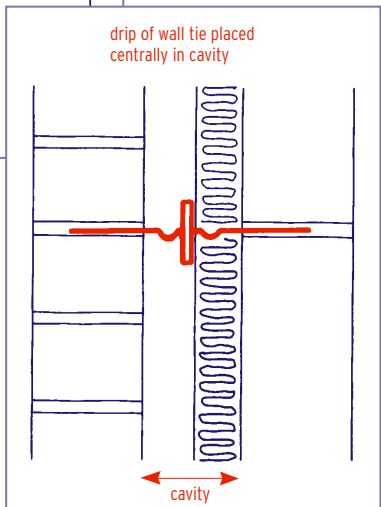
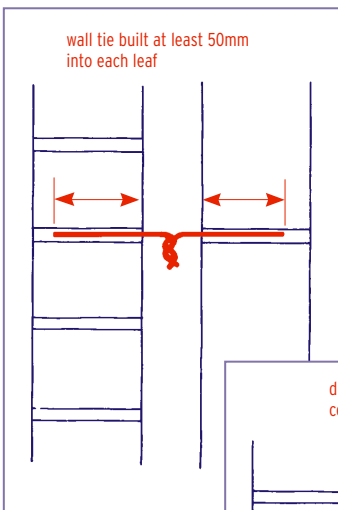


What to do:

- ensure that ties are as specified, and are of the correct type



- bed ties a minimum of 50mm into each leaf
- keep ties clean
- ensure ties are level or slope outwards slightly
- ensure drips face downwards in centre of cavity



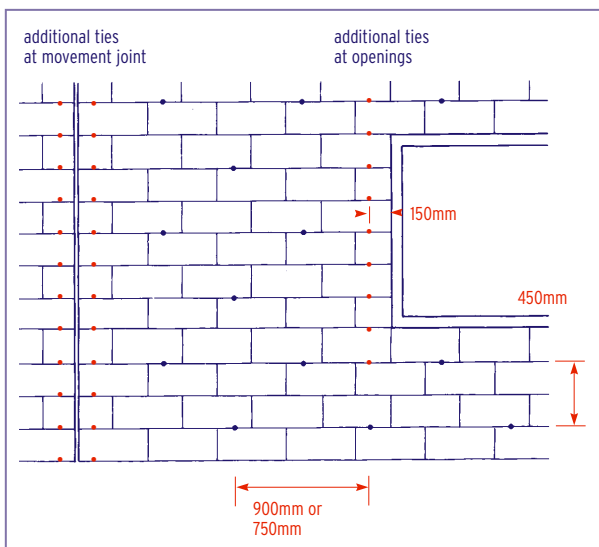
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Wall ties

- space ties correctly:
 - in walls
 - at reveals
 - at movement joints

Cavity width between masonry faces (mm)	Maximum spacing (mm)	
	Horizontally	Vertically
50 to 75	900	450
76 to 100	750	450
50 to 100 (At jamb openings, movement joints, etc)	within 150 of opening	300 or each block course

At openings and movement joints, wall ties should be spaced at maximum 300mm centres vertically even if this means cutting cavity insulation to insert the tie. Doubling the number of wall ties at 450mm or 600mm centres vertically is not an acceptable alternative.



Note: Ties may need to be closer when supporting and retaining partial fill insulation boards.

Mortar

Problems to avoid:

- Low strength
- Variations in mix
- Poor durability

What to do:

- keep mixers and plant clean
- store materials correctly
- ensure that the mix is correct for:
 - bricks/blocks being used
 - location in building
 - exposure of area(see table on page 10)
- do not use masonry cement as if it is OPC. More masonry cement is needed - refer to manufacturer's recommendations
- keep mix proportions consistent



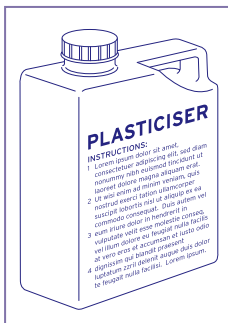
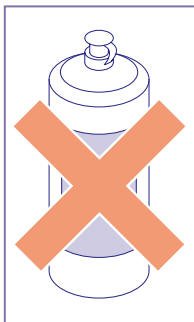
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Mortar

Mortar mixes for clay brickwork using ordinary Portland or sulphate-resisting cement

Location		Recommended cement: lime: sand mix	Recommended cement: sand mix with air-entraining plasticiser	Recommended masonry cement: sand mix
General wall area above dpc	in areas of <i>Severe</i> or <i>Very Severe</i> exposure	1 : 1/2 : 4 1/2	1 : 3 1/2	1 : 3
	- high durability			
	other exposure categories			
	- general use	1 : 1 : 5 1/2	1 : 5 1/2	1 : 4 1/2
Below dpc level and in chimney stacks	- high durability	1 : 1/2 : 4 1/2	1 : 3 1/2	1 : 3
Cappings, copings and sills	- low permeability	1 : 0 to 1/4 : 3	–	–

- do not use washing up liquid



Note: do not overdose; "more is not better" - do not use unauthorised additives such as washing up liquid.

- follow the manufacturer's instructions when using plasticisers or other additives
- protect and store retarded mortars correctly before use
- use retarded mortars within supplier's/manufacturer's time limit
- do not knock up mortar which has started to set



- lay bricks and blocks on a full bed of mortar and fill perpend joints solidly
- do not use recessed joints with full-fill cavity insulation

Thermal insulation

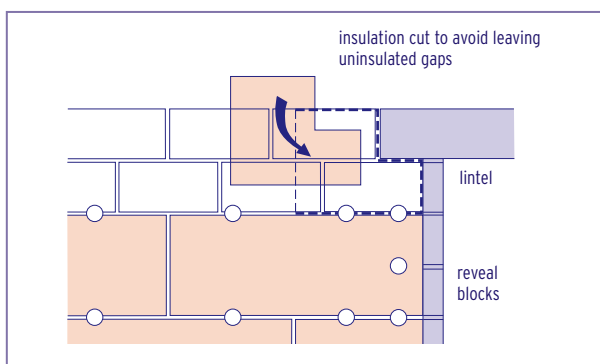
Problems to avoid:

- Water crossing the cavity
- Thermal bridging (cold spots)

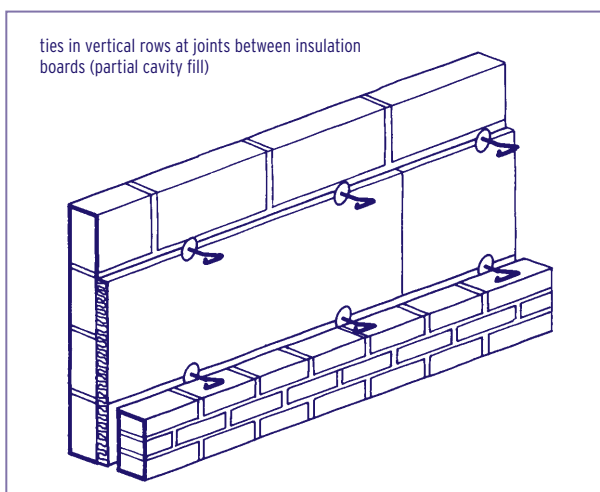


What to do:

- follow the manufacturer's instructions for built-in insulation (see packaging)
- support the bottom row of boards/batts using ties
- insulate the whole wall area, including below dpc
- install boards/batts with staggered joints
- butt boards/batts closely with no gaps
- ensure that insulation is fitted tightly against lintels, cavity trays and cavity closures
- maintain a minimum 50mm clear cavity between partial cavity fill and the external leaf



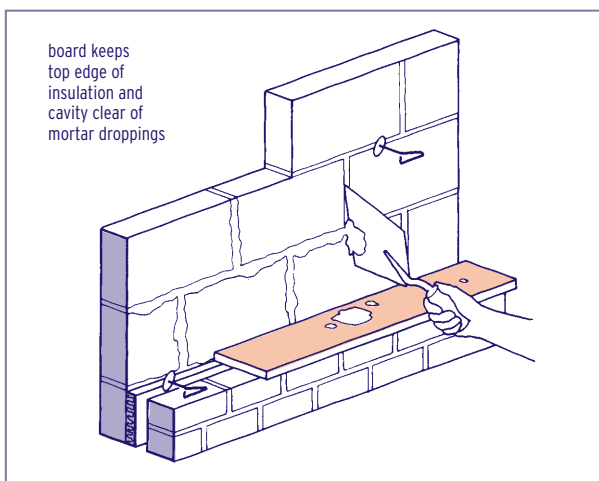
- keep partial cavity fill securely in place using the correct clips for the type of tie
- ensure that horizontal joints in partial cavity fill insulation coincide with wall ties



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Thermal insulation

- keep the top edge of insulation clear of mortar droppings



Openings

Problems to avoid:

- Water crossing the cavity
- Poorly fitted frames

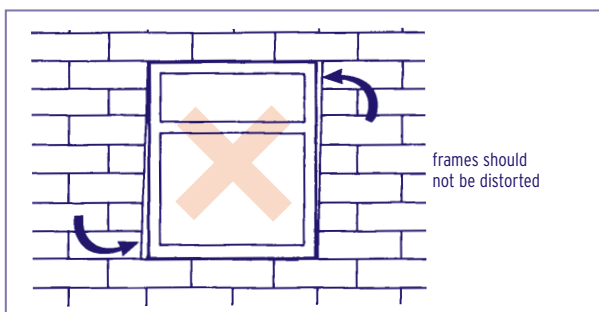


What to do:

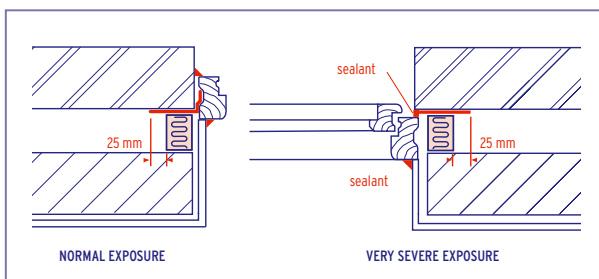
- build masonry around:
 - the frame in-situ
 - a profile/template (frame fitted later)
- ensure openings are of the correct size and square
- butt brickwork closely against the frame (if built-in) (see diagram & photograph on page 16)

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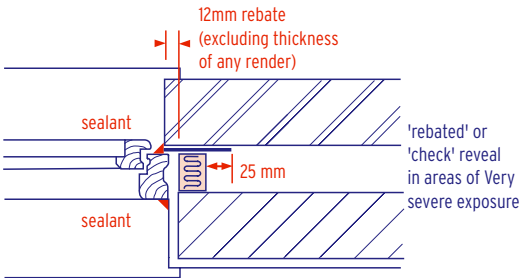
Openings



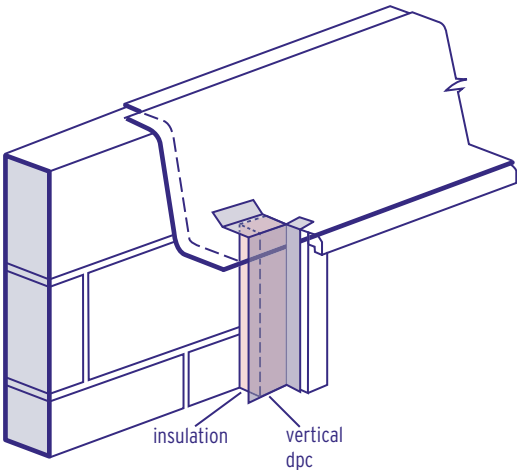
- provide vertical dpcs at jambs (either separate or combined as part of a proprietary cavity closer)
- install dpcs in one continuous length
- where separate vertical dpcs are used ensure they protrude about 25mm into the cavity



Note: Use 'check' reveals in Scotland, Northern Ireland, the Isle of Man and areas of *Very Severe* exposure.



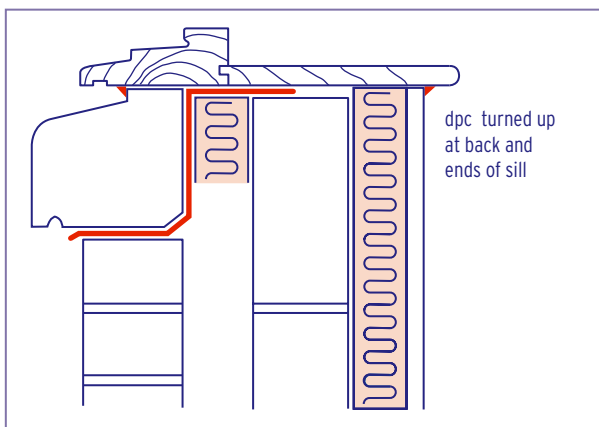
- extend vertical dpcs up to the lintel, and turn back towards the inner leaf



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Openings

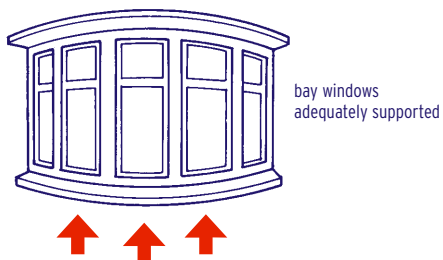
- provide dpcs under jointed and permeable sills, turned up at the back and ends



- fix frames securely into openings - level and plumb
- block/pack frames at fixing points as necessary

To prevent sagging and bowing, bay and bow type windows should be adequately supported and secured to the structure to prevent casements becoming twisted.

Bay windows should be properly linked to dpcs at reveals.





Lintels

Problem to avoid:

- Inadequate structural support



What to do:

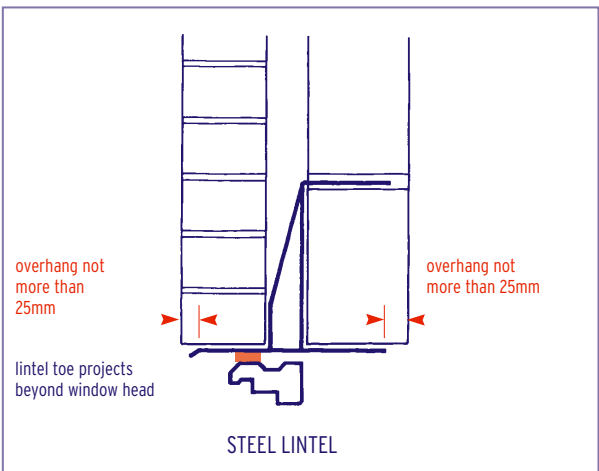
- lintels should extend beyond the opening at each end by at least the following:

Span (m)	Minimum bearing length (mm)	
	Simple lintel	lintel combined with cavity tray
up to 1.2	100	150
over 1.2	150	150

- bed lintels on mortar



- provide padstones where required by the design
- do not allow masonry to overhang edge of lintel by more than 25mm



- build inner and outer leaves up together on steel lintels to avoid twisting the flange (max. height difference 225mm)

Cavity trays

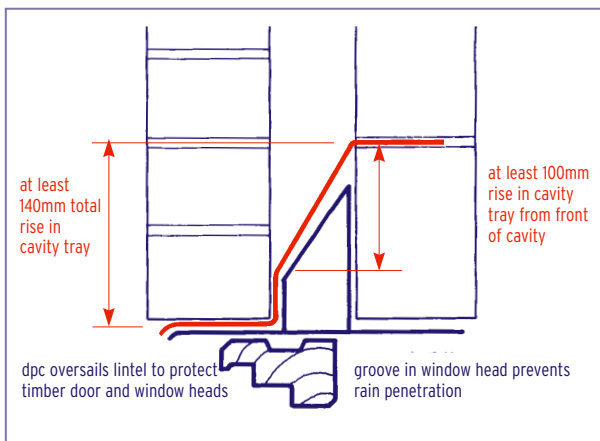
Problem to avoid:

- Water crossing the cavity



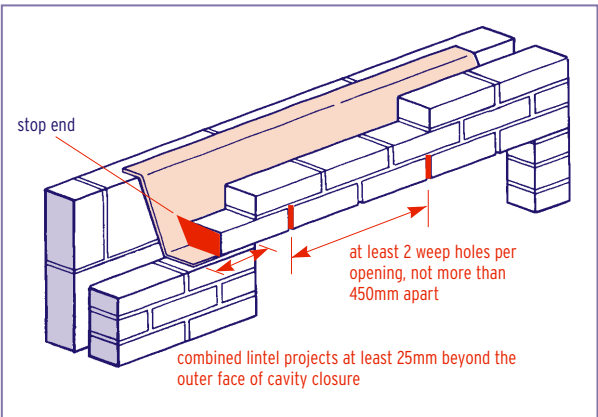
What to do:

- provide cavity trays where required by the design-over lintels, roof abutments, air bricks, meter boxes, etc.
- install cavity trays in one continuous length
- extend trays at least 25mm beyond the cavity closers, and cover the ends of lintels
- shape cavity tray as shown:



Note: Provide a cavity tray where a combined lintel does not have a suitable profile or durability and give complete protection to the top of the reveal and any vertical dpc. In Scotland, Northern Ireland, the Isle of Man and areas of *severe* or *very severe* exposure to driving rain, provide separate damp-proof protection over all lintels.

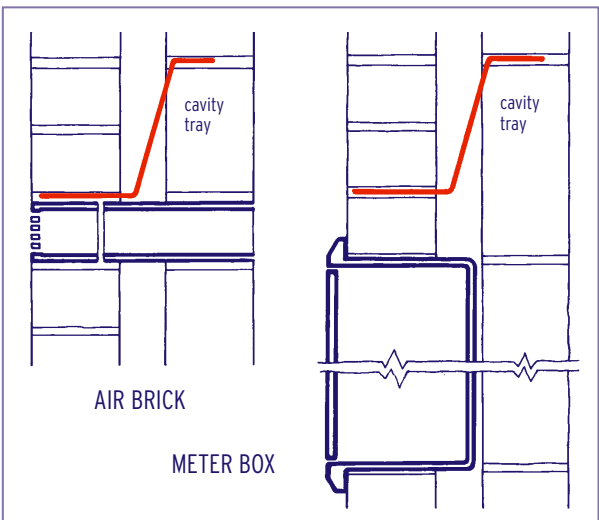
- provide stop ends to cavity trays and combined lintels
- provide weep holes at max 450mm intervals (at least two per opening) with fair-faced masonry



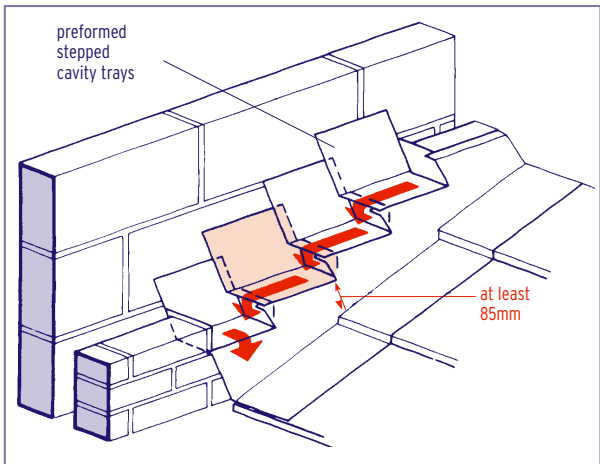
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Cavity trays

- provide a cavity tray over air bricks, etc., extended 150mm beyond each side
- provide a cavity tray over meter boxes (and a dpm behind in areas of very severe exposure)



- provide a cavity tray above full-fill insulation, unless the insulation is taken to the top of the wall
- provide cavity trays at roof abutments over enclosed areas:
 - locate tray to link with flashing
 - the lowest tray should have two stop ends and a weephole



Bonding

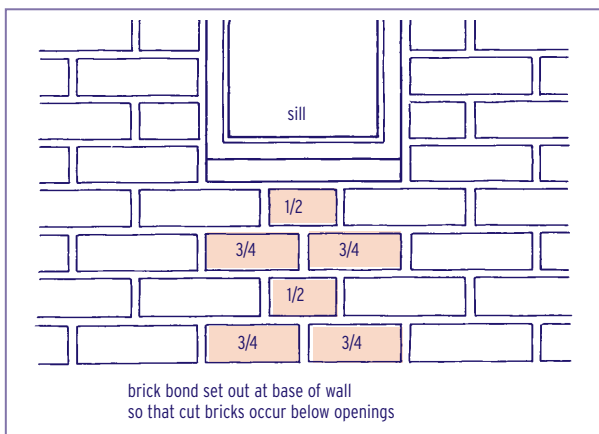
Problems to avoid:

- Unstable walls
- Differential movement
- Poor appearance



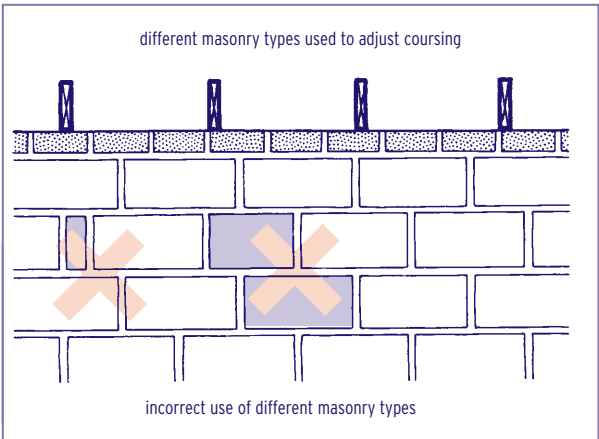
What to do:

- set out work carefully to minimise cutting bricks and blocks



- maintain a regular bonding pattern

- do not mix materials of different types in the same wall

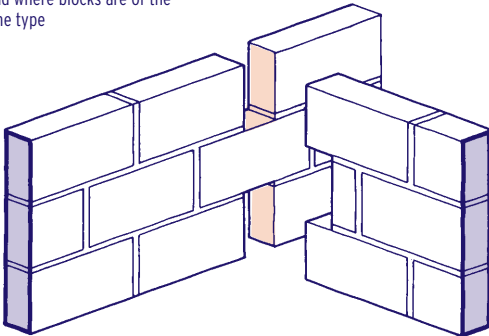


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Bonding

- bond external walls to partitions and separating walls:
 - tooth alternate courses where blocks of the same type are used
 - use wall ties or expanded metal (maximum 300mm centres) to bond dissimilar materials

bond where blocks are of the same type



- where joists are built into masonry (e.g. internal walls), fully fill between joists without excessive mortar joints





Movement joints

Problem to avoid:

- Excessive cracking

What to do:

- provide movement joints in the outer leaf to minimise cracking:

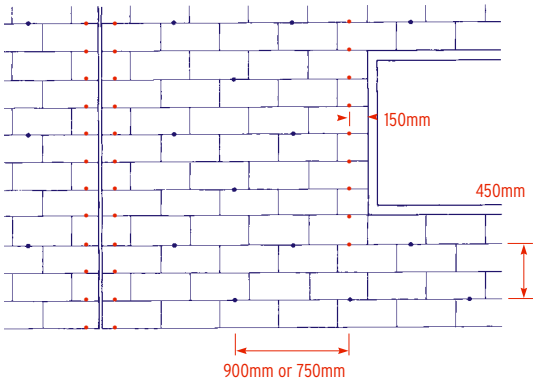


Material	Joint width(mm)	Normal spacing
Clay brick	16	12m (15m maximum)
Calcium silicate brick	10	7.5 to 9m
Concrete block and brick	10	6m
Any masonry in a parapet wall	10	half the above spacings and 1.5m from corners (double the frequency)

The spacing of the first movement joint from a return should not be more than half of the above dimension

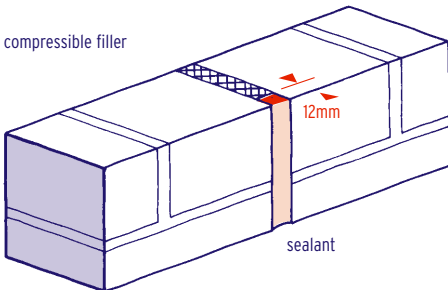
- install ties to each side of movement joints:
 - Vertically - 300mm or each block course
 - Horizontally - within 150mm of the joint

additional ties at movement joint additional ties at openings



- use correct filler material in joints, e.g. for clay brickwork:
 - flexible cellular polyethylene
 - cellular polyurethane
 - foam rubber
- ensure sealant is at least 10mm deep to ensure a good bond

easily compressible filler



Separating walls

Problems to avoid:

- Poor sound insulation
- Inadequate firestopping



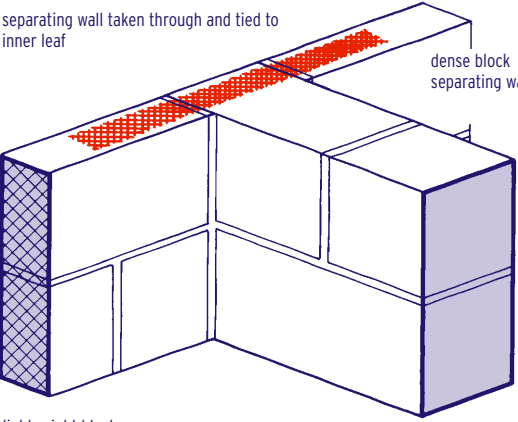
What to do:

- ensure block type and thickness complies with design
- do not use cracked or damaged blocks
- use only butterfly or other approved ties
- maintain clear cavity width (where applicable)
- bed all blocks and fully fill perpend joints
- fill all gaps, however small
- bond external walls to separating walls:
 - tooth alternate courses where blocks of the same type are used
 - carry separating wall through to the cavity and tie the inner leaf to it where the separating wall uses denser blocks than the inner leaf of the external wall

separating wall taken through and tied to
inner leaf

dense block
separating wall

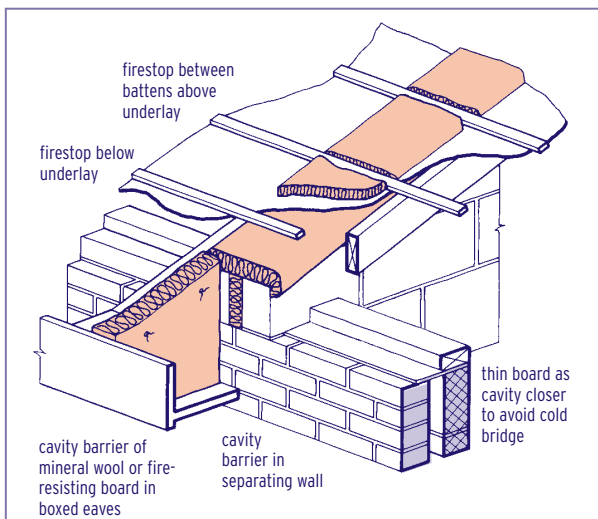
lightweight block
inner leaf



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Separating walls

- install a flexible cavity closer at junction of separating and external cavity walls
- cut/finish blockwork accurately at top of separating wall. Blockwork should stop about 25mm below the top of adjacent roof trusses for firestopping



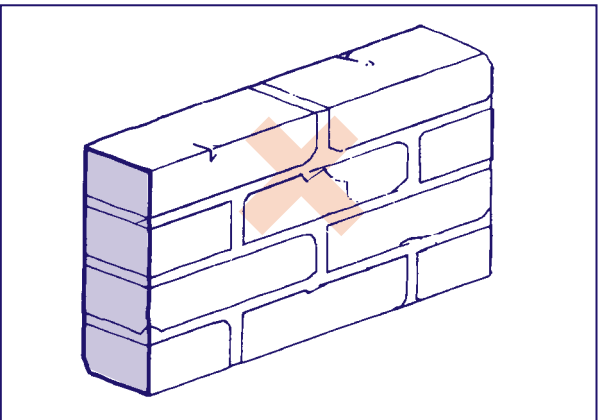
Appearance

Problems to avoid:

- Unsightly brickwork
- Colour variations
- Materials damaged/stained
- Finished work stained

What to do:

- ensure materials are stored correctly, away from site traffic
- protect bricks/blocks from rain, mud splashes, etc
- handle materials carefully during construction
- do not use chipped or fractured bricks for facework



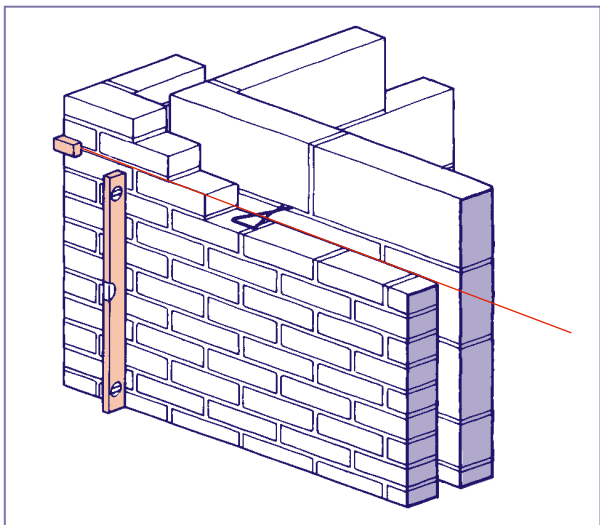
- keep mortar mix and colour consistent (sand variations may be significant)
- unless blended before delivery, mix bricks from different batches to avoid colour patching

continued over

Appearance



- use a gauge rod marked with heights of openings to keep courses to the correct height
- keep work level, plumb, and to design bond
- keep perpend joints plumb



- protect new work from rain and frost
- keep the workplace clean to reduce mortar splashes



- brush off any mortar smears after initial set

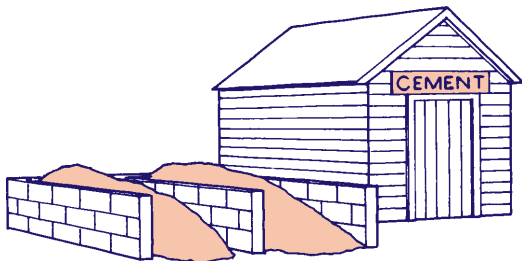
Cold weather working

Problem to avoid:

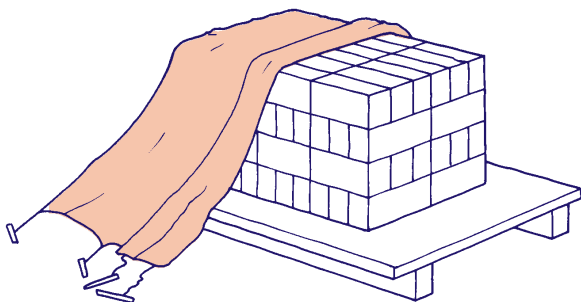
- Frost damage

What to do:

- cover materials to prevent them becoming saturated and damaged by frost

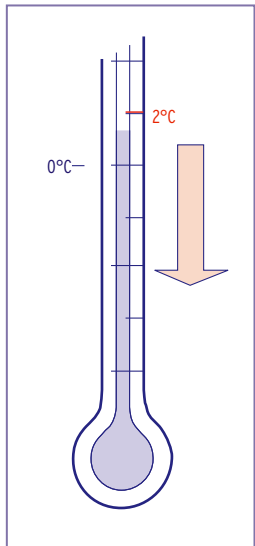


protection of sand,
aggregates and cement

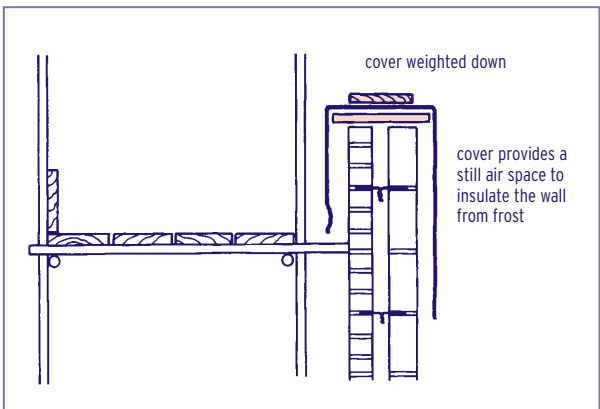


protection of bricks and blocks

- do not lay brickwork or blockwork when the air temperature is below or likely to fall below 2°C



- protect new work from frost when the air temperature is below or likely to fall below 2°C



- take down and rebuild work damaged by frost

Additional guidance for timber frame

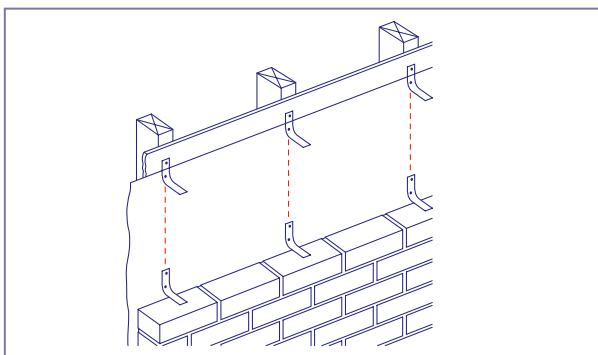
Much of the guidance in previous sections applies also to timber frame. This section highlights additional problems specific to brickwork and blockwork used as cladding for timber frame homes.

Problems to avoid:

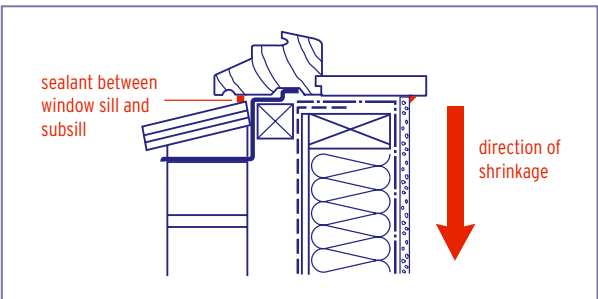
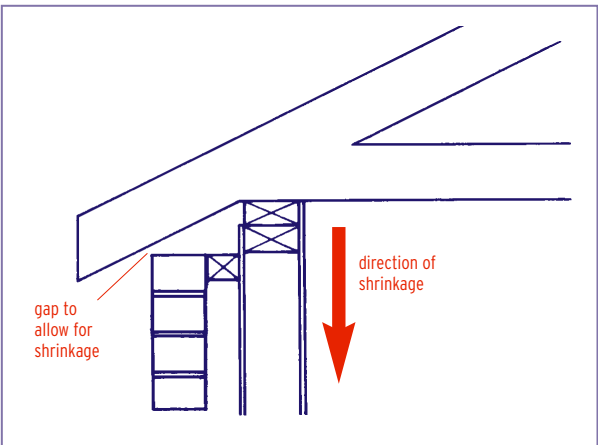
- Moisture damage to the timber frame
- Masonry cladding not tied to frame adequately
- Damage due to movement of the timber frame
- Inadequate control of fire

What to do:

- repair any damage to breather membrane
- fix ties to the studs, not the sheathing
- use the fixings specified in the design
- space ties in accordance with the design, but not more than 600mm horizontal and 450mm vertical spacings
- at jambs of openings set ties within 300mm of the masonry reveal at 300mm maximum vertical spacings

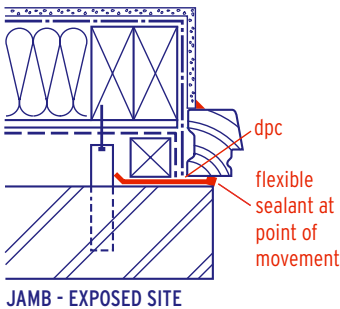
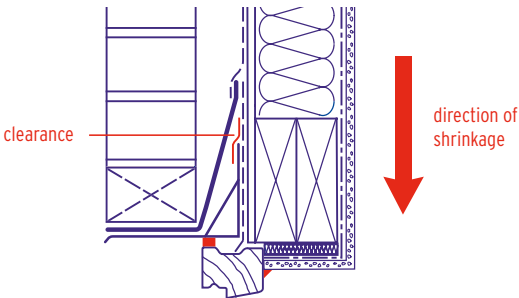


- make sure ties slope away from the sheathing
- allow for movement of the timber frame in accordance with the design at:
 - the eaves
 - sills of openings
 - heads of openings
 - jambs of openings



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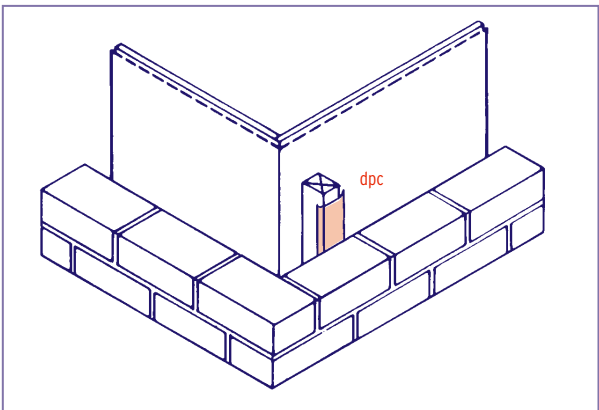
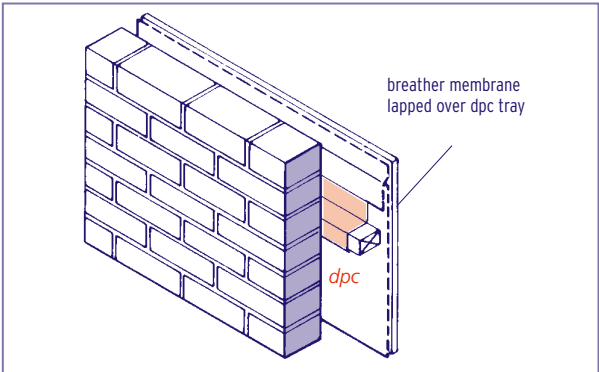
Additional guidance for timber frame



- for platform construction, use the designer's recommendations or the following allowances to accommodate differential movement

Location	Suspended timber ground floor when panels are supported on ground floor joists or perimeter joists	Other ground floor construction
Ground floor openings	5mm	3mm
First floor openings	12mm	9mm
Second floor openings	18mm	15mm
Eaves and verges	Add 3mm to the allowance for openings on that floor	

- install cavity barriers in accordance with the design



	Notes	

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Notes

[illegible]

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