Unit CSA–L2O cc731
CONSTRUCT CAVITY WALLING FORMING MASONRY STRUCTURES

LEARNING OUTCOMES
LO1/2: Know how to and be able to prepare for constructing cavity walling forming masonry structures
LO3/4: Know how to and be able to construct cavity walling to the given specification
LO5/6: Know how to and be able to form openings in cavity walling to the given specification
INTRODUCTION

The aims of this chapter are to:

- help you to select materials, components, tools and equipment
- help you to build cavity wall structures.

PREPARING TO BUILD CAVITY WALLING
FORMING MASONRY STRUCTURES

Cavity walls, as their name suggests, consist of two separate walls with a space between them. The outer wall is usually brick and the inner wall is block. The walls are fixed together using metal ties.

It is the cavity itself that creates a barrier. It protects the inside of the building from water and poor weather conditions. The water cannot pass into the inner wall because the air that is circulating inside the cavity dries out any damp.

Damp-proof courses are needed wherever the walls are physically joined. This is particularly true around openings.

In practice, the cavities are not really empty. They are insulated in order to ensure that the inside of the structure remains warm and to improve its energy efficiency. To conform to Part L of the Building Regulations, current practice is that 100mm thick insulation is utilised. This will fill the cavity entirely.

Hazards, health and safety and risk assessment

Many of the potential hazards in building cavity walling are the same as those that apply to the building of other structures. There is specific information about working at height later in this chapter. You should refer to Chapter 1, pages 2–13, which dealt with health and safety.

Drawings, specifications and schedules

Once again, drawings, specifications and schedules will be your main reference material for any work you are carrying out to build cavity walling. More information about drawings, specifications and schedules can be found in Chapter 2, pages 41–7.

PPE

The exact PPE that you will need when you are building cavity walling will depend on the nature of the work. To remind yourself of the types of PPE you might need, refer to Chapter 1, pages 31–3.
Resources, tools and equipment

The range of suitable tools and equipment can be found in Chapter 5, pages 136–7, about building solid walling.

The main materials you will be using are:

- bricks
- blocks
- lintels
- cavity frames
- cavity trays
- wall ties
- damp-proof course.

We need to look at these in a little more detail.

Bricks and blocks

The type of brick or block will depend on the specific job. The bricks and blocks used for cavity walling are relatively resistant to moisture.

Other characteristics could determine whether or not they are chosen for a job. For example, they may be fire resistant or good insulators.

There are two main types of block that are used – concrete or lightweight insulation. The concrete blocks can be solid or hollow, and have different kN (kiloNewton ratings, indicating the force of gravity acting on the blocks) ratings to indicate their different strengths. Solid blocks tend to be used for commercial and industrial purposes. Hollow blocks often have rods running through them and they are then filled with concrete. Lightweight blocks have become commonplace for health and safety purposes. They also have better insulation values.

Table 6.1 outlines the main types of brick and block that you are likely to use for cavity walling.

<table>
<thead>
<tr>
<th>Type</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common bricks</td>
<td>These are of low quality compared to other types of brick. They are used for work that is not going to be seen. They do not have a great ability to withstand heavy pressures or weights.</td>
</tr>
<tr>
<td>Facing bricks</td>
<td>These are the bricks that will be visible on the outside of the building. As a result they have a better and more attractive surface, which could be textured.</td>
</tr>
<tr>
<td>Engineering bricks</td>
<td>These are rated as either A or B. A is the strongest type of brick and B class bricks are sometimes called semi-engineering bricks. Both are ideal for damp-proof courses or for below-ground-level building work. They have a high strength, which is known as compressive strength, so they can withstand heavy pressures and weights. They are also less likely to absorb water.</td>
</tr>
<tr>
<td>Concrete bricks</td>
<td>They are good thermal insulators and also provide insulation from external noises. They are also fairly fire resistant.</td>
</tr>
<tr>
<td>Sand and lime bricks</td>
<td>These can be used instead of facing bricks and are available in a variety of colours and textures.</td>
</tr>
<tr>
<td>Dense concrete blocks</td>
<td>These are solid, heavy concrete blocks. They are designed to be laid up to the damp-proof course. They are also used to build the outer leaf of a cavity wall and then rendered.</td>
</tr>
<tr>
<td>Lightweight insulation block</td>
<td>These are less dense but good insulators and are used for the majority of the inner leaf of a cavity wall.</td>
</tr>
</tbody>
</table>

Table 6.1 Different types of brick and block for cavity walling
Lintels
Lintels are placed above openings in the walls. These are designed to support any brick or blockwork above the opening. They are usually made from concrete with steel reinforcement or from galvanised steel.

Cavity frames
It is not possible to fit doors or windows into walling without first putting in some linings and frames. These are designed to match the specified size of window or door and allow the component that will fill the opening to fit flush and gap-free.

Cavity trays
Cavity trays are moisture barriers. They have a lip or interlocking edge on each end. At the back of the cavity tray there is a flap shape, which can be adjusted to the inner wall. You can also install a tray using a plastic damp-proof course which comes on a roll. The roll must be wide enough to be built in to a course of blocks above the internal lintel and stepped down over the cavity to a course above the external lintel. Weep vents must be installed every 450 mm to allow moisture to drain out from the tray and let fresh air into the cavity.

The idea is that the cavity tray will encourage moisture away from the inner wall. The curve on the back achieves this.

Wall ties
There is more information on wall ties later in this chapter. But it is important to stress here that wall ties are vital when building cavity walls. Cavity walls should not be built without ensuring that both the inner and outer leaves are held together. The thickness of the wall involved means the wall would be unstable without wall ties. Wall ties are made from rust-proof metal and have twists in them. It is the twist that stops water from travelling from the outer leaf to the inner leaf. In effect this is a drip system.

Damp-proof course
Some specific advice is included later in this chapter, but it is worth stressing here that damp-proof courses are an important way of stopping moisture from entering a building. Moisture can come up from the ground, so a damp-proof course just above ground level is vital to prevent this.

The cavity between the inner and outer leaves, along with other components such as cavity trays, prevents water from getting through the walls.
Preparing and cutting components

Cutting can be done either by hand or with a machine. The exact method will depend on the block or brick you are using. Obviously you would not try to hand saw a dense concrete block or engineering brick. For these you would have to use a bolster chisel and hammer. Other blocks and bricks can be cut using disc cutters or table saws.

Angle grinders are also very useful and are used mainly for cutting bricks and other blocks. Some construction sites have petrol cutters. These have extra-strong diamond cutting discs.

Protecting the work and surrounding area from damage

It is important to remember that when carrying out your work you should always try to bear in mind these points:

- Minimise damage to the area – only clear ground right next to you to give you enough working space.
- Maintain a clean working space – do not leave the working space cluttered with debris, tools, materials and equipment. Always tidy up after yourself to prevent contamination of the site and health and safety hazards.
- Dispose of waste – sort your waste into types. Some of it, such as plastic, can be recycled. Bits of brick and block may be useful for hard core. You should have separate bins or skips for particular types of waste on site.
- Make the construction sustainable – by following correct building procedures and ensuring your work is of top quality. The building should have a long and trouble-free life. It will also be energy efficient and meet all environmental challenges.

BUILDING CAVITY WALLING TO THE GIVEN SPECIFICATION

Walls may be built as solid walls, that is, having one thickness only, or cavity walls, being made of two walls (not necessarily of equal thickness), with a space in between. These walls are called leaves and are generally referred to as the outer leaf and inner leaf. The space or hollow in between the walls has two main advantages:
1. When the outer leaf becomes wet, the space prevents water passing from the outer wall to the inner wall, and so the inside of the building remains dry.

2. The space will not allow heat to be transferred from one wall to the other. Air is a bad conductor of heat and the cavity acts as a barrier. The cavity, therefore, is a good heat insulator and helps to keep the building cool in summer and warm in winter.

If the cavity is sealed at the base, eaves, and all the jambs of openings, then the air trapped inside will be static and this will ensure good heat insulation for the building.

The cavity should be large enough to provide suitable insulation, but not so wide as to make it difficult to tie the two walls together. The Building Regulations state that the width of the cavity at any level should be not less than 50 mm or more than 100 mm where ties are placed at distances apart not exceeding 900 mm and 450 mm vertically.

A cavity may be not more than 100 mm wide if vertical twist-type ties are used and are placed at distances apart not exceeding 750 mm measured horizontally and 450 mm measured vertically.

**Foundations**

Cavity walls for housing may be built directly off the foundation concrete; no footing courses are considered necessary, as long as the ground immediately below the foundations is suitable for carrying the load of the building. In these cases the cavity is usually filled with a concrete consisting of a small aggregate, not exceeding 10 mm, and cement. One part cement to six parts aggregate is suitable.

The filling is taken up to ground level and finished off to a steep slope, falling towards the outer leaf at the top. This slope will direct any accumulation of water which may collect inside the cavity away from the inner leaf. Water may enter the cavity when rain passes through the outer leaf, runs on to the wall ties, and drips off the middle of the ties into the cavity.

**Condensation**

Moisture may also develop from condensation, when the warm air in the cavity is cooled on the inside face of the outer leaf of the cavity wall. Warm air holds more water than cold air, so when the temperature of the air is lowered, water is released in the form of droplets, known as condensation.

It is important to dispose of this water as soon as possible and prevent it collecting in the base of the cavity, so, in addition to the slope on the top of the filling, weep holes are sometimes left in the outer skin of the wall at the first course above the slope of the filling. The weep holes are formed by raking out the mortar in the perpend joints about every metre along the wall. The joints should be completely free from mortar so that the water can drain away quite freely.
An alternative method is to build the wall solidly at the base and then begin the cavity at ground level, or at 150 mm below the damp-proof course, as shown in Fig 6.1.

**Building cavity walling**

Blockwork should be laid out at half bond. It is usual practice to lay out the blocks before mortaring them into place, in order to look at the bond possibilities. Usually a cut piece of block will be needed to complete the course.

**Straight lengths**

When you finish with a full block on the course below, you build the wall with straight joints, using a half block. This means that you work back towards the first corner.

In Fig 6.2 load-bearing insulation blocks are used for the internal part of the cavity wall, (marked A). Foundation blocks 250 mm thick or greater are used for cavity walls (marked B). Load bearing foundation blocks are required below load bearing walls (marked C). The load-bearing walls need blocks of between 100 and 250 mm (marked D). Standard blocks are used for non-load bearing walls and can be between 75 and 250 mm (marked E). Aerated blocks can also be used.

See page 235 for information about returns and junctions.

The following practical tasks show you the steps you need to take in order to build a variety of different types of cavity walling. Always check regularly that the walling is both level and plumb.
1. Build a cavity wall with party wall junction

**Objective**

To build a straight section of cavity wall. The block leaf is to have a party wall junction installed.

This can be seen on buildings where adjoining properties require a cavity wall that is filled with insulation for both sound and insulation properties.

Ensure you select PPE appropriate to the job and site where you are working. Refer to the PPE section in Chapter 1.

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**Diagram Description**

- **Figure 6.2** Section view of a house showing blockwork

- **Figure 6.3** Cavity wall with a party wall junction

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**TOOLS AND EQUIPMENT**

<table>
<thead>
<tr>
<th>Walling trowel</th>
<th>Spirit level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lump hammer</td>
<td>Corner block and lines</td>
</tr>
<tr>
<td>Bolster chisel</td>
<td>Builder’s square</td>
</tr>
<tr>
<td></td>
<td>Straight edge</td>
</tr>
<tr>
<td></td>
<td>Jointing iron</td>
</tr>
<tr>
<td></td>
<td>Steel tape measure</td>
</tr>
</tbody>
</table>

**STEP 1**  Set out and dry bond the wall 2,240 mm long. Bed the first brick, level and to gauge at the highest end of the floor. Then bed another brick at the other end. Level the second brick with the first using a spirit level and straight edge.

Check the alignment with the straight edge and then re-check all the previous criteria so that length, level and alignment are all correct before walling starts.

**PRACTICAL TIP**

If you use the spirit level and straight edge to transfer the level, remember to rotate it 180° in order to eliminate any possible inaccuracies.

**STEP 2**  If you just put the corner blocks and line onto these two bricks when the mortar is still wet, it will pull them out of place. You can overcome this by placing two or three bricks onto the top of the two end bricks to stop them from moving.

The bricks can then be laid in to complete the first course.

**STEP 3**  Build the second course to DPC height (150 mm).

**STEP 4**  Repeat Steps 2 and 3 for the inner leaf.

The inner leaf of the cavity must also be two courses of bricks high so that the subsequent brick and block courses are correct.

Set out the party wall 900 mm from the right hand end of the model and checked for square to the main wall.

**STEP 5**  Lay a thin screed of mortar on top of the second course so that the DPC can be laid. As you are laying the DPC, gently run your walling trowel over the top of it and press the DPC into the mortar screed.

This is not to stick the DPC down, but to protect it from high spots or sharp areas that may puncture it and stop it working. Any overlaps in the DPC should be a minimum of 100 mm.

**STEP 6**  Build the block corners first. When running the blockwork in, the party wall section should be left until last on each course and then checked to the line with a spirit level. If you lay the blocks at the party wall then the line could snag on the blocks and the rest of the blockwork would be inaccurate.
**STEP 7** Wall in the blocks between the corners using corner blocks and line.

Place wall ties 225 mm vertically at the unbounded ends of the cavity, and at 450 mm vertically (every two course of blocks) throughout the body of the wall. Put in a diamond pattern as much as possible, so that the ties are taking equal loads. Horizontal spacing should be 900 mm max and the ties at the stop ends should be placed 225 mm from the edge, so as not to interfere with any methods of closing the cavity.

**STEP 8** Now the brickwork can be constructed. As usual, build small corners first and then run in with the line in order to gain the best efficiency.

**STEP 9** The wall should be finished with a half-round joint on the brickwork and a flush finish on the block leaf. Brush the wall when the mortar is dry enough to do so without leaving any brush marks.
2. BUILD A CAVITY WALL WITH EXTERNAL RETURN

OBJECTIVE

To complete a section of cavity wall to the required standards. The wall will include an external return as well as a junction.

TOOLS AND EQUIPMENT

Walling trowel
Lump hammer
Bolster chisel
Spirit level
Corner blocks and line
Builder’s square
Straight edge
Jointing iron
Steel tape measure

Ensure you select PPE appropriate to the job and site where you are working. Refer to the PPE section in Chapter 1.

The measurements required are:

- Length of wall 2,240 mm
- Height of wall 1,050 mm
- Width of cavity overall 300 mm
- Lengths of brick return 778 mm

STEP 1 Set out and dry bond the wall 2,240 mm long. Bed the first brick, level and to gauge at the highest end of the floor. Then bed another brick at the other end. Level the second brick with the first using a spirit level and straight edge.

Check the alignment with the straight edge and then re-check all the previous criteria so that length, level and alignment are all correct before walling commences.

STEP 2 Lay the bricks to complete the first course. The return corner can then be established to the correct length and checked for being 90° with either a builder’s square or the 3:4:5 method. The air brick should be dry bonded into position and can then be run in with the second course.

Build the second course to DPC level (150 mm).
Step 4  Repeat Steps 2 and 3 for the inner leaf. The inner leaf of the cavity must also be two courses of bricks high so that the subsequent brick and block courses are correct.

The liner for the air brick should then be positioned opposite the air brick.

Step 5  Lay a thin screed of mortar on top of the second course so that the DPC can be laid. As you are laying the DPC, gently run your walling trowel over the top of it and press the DPC into the mortar screed.

This is not to stick the DPC down, but to protect it from high spots or sharp areas that may puncture it and stop it working. Any overlaps in the DPC should be a minimum of 100 mm.

A damp tray should be cut over the air brick, so that the ends can be turned up into the cross joints, and the upper section bedded into the block course in the inner leaf.

Figure 6.10  Fitting the damp tray

Step 6  Build the block corners first so that the insulation can be applied before the outer leaf is formed.

When running the blockwork in, leave the return on each course until last and then check it to the line with a spirit level. This prevents the accuracy of the line being compromised and leading to any error.

Practical Tip
It may help to position the wall ties on top of the DPC to support the insulation. On site, the insulation may protrude below DPC and the tie will be applied accordingly.
STEP 7  Place wall ties 225 mm vertically at either of the unbonded ends of the cavity and the ties at the stop ends should be placed 225 mm from the end, so as not to interfere with any methods of closing the cavity, and at 450 mm vertically throughout the body of the wall. Put them in a diamond pattern as much as possible, so that the ties are taking equal loads. Horizontal spacing should be 900 mm max but may be reduced to support the insulation.

STEP 8  Apply the insulation and cut it to fit so that it is bonded in much the same way as stretcher bond is. It should be cut at the ends so that you can fit any cavity closers without having to alter the insulation. The amount to be cut depends on the depth that the closer sits in the cavity, but 50 mm should be sufficient. Then the insulation can be fixed with the appropriate plastic clips.

STEP 9  Construct the brickwork. As usual, start by building small corners and then run in with the line in order to gain the best efficiency. You will have to insert the cavity closers at the same time as you build the corners. Most closers come with plastic clips that need to be built into the bed joints of the brickwork.

STEP 10  Finish the wall with a half-round joint on the brickwork and a flush finish on the block leaf. Brush the wall when the mortar is dry enough to do so without leaving any brush marks.

3. BUILD A CAVITY WALL WITH RETURN AND RUSTICATED CORNER

OBJECTIVE
To build a cavity wall with a return corner, with the addition of a rusticated corner and a window with a soldier course.

Both the quoin and soldier course are mainly decorative features that can enhance the appearance of what can be rather plain cavity walls.

TOOLS AND EQUIPMENT
Walling trowel
Lump hammer
Bolster chisel
Spirit level
Builder’s square
Corner blocks/pins and line
Straight edge
Jointing iron
Steel tape measure
Boat level
**Step 1** Follow Steps 1 to 6 from the practical task, Build a cavity wall with external return, on page 187.

**Step 2** Lay the first course of blocks placing the wall ties where necessary.
Mark out the position of the opening on the finished course of blocks with the aid of a thin mortar screed.

**PRACTICAL TIP**
It’s good practice to make the opening on the blockwork slightly bigger so that it does not project past the brick opening on the outer skin.

**Step 3** Complete the blockwork.
Leave half a block of space at either side of the opening for the lintel bearing at the top of the block wall.

**Step 4** Install the insulation and fix it with the appropriate ties.

**Step 5** Set out the corner using a contrasting brick for the rustication with a projection of 15 mm. Build a small return corner.
At this stage it is better to build up the three courses on the rusticated corner and complete the brickwork in between them.
It is essential that the inside edge of the projection is also plumbed so that the corner has a plumb line down the block-bonded quoin.

**Step 6** Bed the lintel on a thin screed of mortar, so as not to make the bed joint of the soldier course too high.

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Ensure you select PPE appropriate to the job and site where you are working. Refer to the PPE section in Chapter 1.

The measurements required are:
- Length of wall 2,465 mm
- Height of wall 11,275 mm
- Length of return 665 mm (brickwork)
- Cavity overall 300 mm

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Figure 6.11  Cavity wall with return and rusticated corner

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![Diagram of cavity wall with return and rusticated corner:](image)
PRACTICAL TIP
If the lintel is rocking, place some mortar under the opposing corner to make it stable.

STEP 7 Build the last three courses of bricks. Make sure that you finish at the sides of the opening and that you make sure the ends are plumb.
Place the damp-proof tray across the lintel with the ends turned up into the cross joints.

STEP 8 Check the width of the opening with a tape measure to make sure that the soldier course will fit. You may need to make the joints larger or smaller to lay the soldiers fit with evenly spaced joints. Ideally the opening should be 910 mm for the bricks to fit correctly with a 10 mm joint.

Figure 6.12 Building cavity tray over lintel
Figure 6.13 Placing weep holes
Figure 6.14 Checking length of the soldier course
Figure 6.15 Checking level of the soldier course
Figure 6.16 Laying the soldier course with weep holes
**STEP 9** Lay the soldier course. Some bricklayers will use two lines for walling in the soldier course, one at the top and one about two-thirds of the way up from the bottom. Keep checking each brick with a boat level for plumb.

Add weep holes after the first soldier from each end and place one in the middle of the opening.

**PRACTICAL TIP**
Always select the bricks for the soldier course. They should be the same size and have good straight edges on the face of the brick. This will make it easier to lay the soldier course. It is good practice to stand back every three bricks and take a look at the bricks to make sure that they look right. When laying the soldiers, it helps to get the cross joint as close to perfect as possible, before lowering it to the line. Angling the mortar, so that there is more mortar at the front of the bed, will help to prevent bricks from tipping forwards.

**STEP 10** Check the bottom alignment with a suitable straight edge such as a spirit level.

**STEP 11** Finish the brickwork with a half-round joint to the brickwork and a flush joint to the blockwork.

**PRACTICAL TASK**

**OBJECTIVE**
To develop practical skills by building a cavity wall with a gable end.

**TOOLS AND EQUIPMENT**
- Walling trowel
- Lump hammer
- Bolster chisel
- Spirit level
- Corner block/pins and line
- Straight edge
- Jointing iron
- Steel tape measure
- Builder’s square
- Appropriate sized roof truss

Ensure you select PPE appropriate to the job and site where you are working. Refer to the PPE section in Chapter 1.

The measurements required are:
- Length of wall 2,240 mm or to suit the temporary roof truss
- Width of cavity 300 mm
- Overhang for the oversail 36 mm
**Step 1** Position the timber roof truss that is representing the gable end of a house, then mark the position of the inner wall in relation to it.

**Step 2** Bed the blocks at either end and run in to form the first two courses.

**Step 3** Build the blocks in front of the truss, cutting the end blocks to the angle of the truss. When bedding the blocks, make sure that they do not protrude above the roof truss or the roof tiles will not fit onto the roof.

When cutting the blocks place the blocks onto 10 mm packers of timber to maintain accuracy and mark the block in line with the angle of the roof truss. Cut the blocks, saving any off-cuts that could be used on another section and lay to the line.

**Step 4** Set out the bricks with the correct spacing to form the cavity required and lay the first course.

**Step 5** Build the corners for the first three courses and run in the brickwork between the corners.

**Practical Tip**
If there are no 10 mm packers available, the block or brick can be positioned on the course underneath it with a 20 mm spacing from the adjacent block/brick. When cut and positioned, this will allow for a 10 mm bed and cross joint. It is not necessary at this stage to build the block skin to full height if the wall is becoming unstable. On site, large gables would also be built in sections in this way and they would be anchored to the roof trusses with galvanised steel fixing brackets.
**Step 6** Build the oversail courses with an overhang of 36 mm on each course and run in the brickwork between the corners.

**Step 7** As with the blockwork, build in the full bricks to the gable first. On a large gable, small pyramid corners can be built and run in to the line.

**Step 8** Fix a timber strut at the top and bottom of the roof truss. A line can be attached for marking the bricks to the raking cut.

**Step 9** Mark the brick to be cut using the spacers or the 20 mm method and cut to suit, while saving any off-cuts in case they can be used on another section. Bed the cuts to the line, checking that they are level and are not above the line of the roof truss.

**Step 10** Build to the top (along with the blockwork if the gable has been built in stages) and finish with a half-round joint, brushing it when ready.

**Practical Tip**
To check for any high spots on a cut, eye the back arris of the cut with the front while closing one eye. This will enable you to spot any extra material that will need to be removed from the cut face.

Figure 6.21 Building the oversail

Figure 6.22 String a line to the gable

Figure 6.23 Building up the courses to the gable

Figure 6.24 The finished wall

Figure 6.25 Insulation in the cavity
Tips for getting your cavity walls right

Marcus Chadwick is a bricklayer at Laing O’Rourke.

‘You must make sure your setting out is right, make sure your DPC (damp-proof course) is in place. Make sure your positioning of the ties is correct from outer leaf to inner leaf, that your insulation is pegged back properly, and you’ve put discs over your ties.

Always make sure your cavities are clear – never leave what we call ‘snots’ on the back of the brickwork. If any more drop down on top of them, it’s a collective process – it could bridge the cavity and that’s when you’ll start getting damp penetration to the inner leaf and ultimately damage the plaster. Cleanliness of the cavities is paramount.

In order to go back down to ground level and clean it out, we leave the odd brick out on top of the DPC so we can do a cavity clean once we’ve got the wall to height. We get some hessian rolls, cut a length out, feed it through from the outer leaf through the missing brick, into the cavity and then back out. We keep doing that so it forms a continuous loop, and then when we’ve finished the job, we pull the hessian out and it brings all the waste mortar with it, so there’s no chance of any bridging. And it keeps your boss happy too!’

Damp-proof barriers

Wall ties need to be free from mortar droppings when the wall has been completed. If this is not checked then the mortar can form a bridge across the cavity. This bridge will allow water to pass across the cavity and the inner leaf may become damp.

Other places where dampness may penetrate to the inner leaf are at reveals, heads of openings and sills. Therefore a damp-proof membrane should be provided at these points so that the interior will be kept as dry as possible. Figs 6.26 to 6.30 show methods of sealing the cavity at these places.
Insulation

Under Building Regulations it is a requirement to ensure that cavity walls are insulated. The Building Regulations outline, according to specification, exactly how much insulation is needed.

During the construction of blockwork walling, wall ties are used to stabilise the structure. A total fill requires the cavity to be filled with insulation slabs or boards, with the wall ties positioned above each section of insulation. Insulation slabs or boards come as standard in 450 mm × 1,200 mm sizes and are made from mineral fibres.

An alternative is to partially fill the cavity walling. Wall ties are used to keep the insulation in place but the insulation slab or board is held against the inner wall by plastic clips.

The final alternative is to inject insulation into the cavity after construction. This is usually polystyrene granules or rock wool fibreglass. Holes are drilled into the inner walls and the insulation is pumped into the cavity. This is the technique used for new builds.

In order to make sure that the walling is suitable, the cavity has to be at least 50 mm wide.

The masonry and brickwork need to be in good condition for insulation to be added.

When insulation is fitted to existing buildings small holes (approximately 22 mm in diameter) are drilled into the walls at intervals of around 1 m. Insulation is then blown into the cavity and the holes are filled.
Typically, insulation for cavity walls can be made from three different types of material:

- mineral wool
- beads or granules
- insulation foam.

When insulation is being fitted into new cavity walling it needs to comply with British Standards and will usually have a guarantee of 25 years.

**Decorative features**

There are many ways in which decorative features can be incorporated into a cavity wall construction project. These are often called design detailing. They aim to give distinctive features to the external appearance of the building. Table 6.2 outlines some of the ways in which this can be done.

<table>
<thead>
<tr>
<th>Decorative feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog tooth courses</td>
<td>These are courses of bricks that consist of cut bricks laid at 45° to the main face of the wall. This makes the bricks look as if they are triangular in shape.</td>
</tr>
<tr>
<td>Quoins</td>
<td>These are bricks that project from the face of the external wall. They can be in a contrasting colour.</td>
</tr>
<tr>
<td>Polychromatic brickwork</td>
<td>These are bricks of different colours, so that patterns on the face of the wall can be created. The bricks can also be bedded in with different coloured mortars to match or contrast with the bricks.</td>
</tr>
<tr>
<td>String courses</td>
<td>These are bricks that project slightly beyond the face of the main wall. They can be different colours, shapes or even made with panels, and some are textured.</td>
</tr>
<tr>
<td>Soldier courses</td>
<td>This is a row of bricks orientated in the same direction and placed on their sides. They are commonly used for edging.</td>
</tr>
<tr>
<td>Dentil courses</td>
<td>These are projecting alternate headers put in to form regular patterns.</td>
</tr>
<tr>
<td>Band courses</td>
<td>These are decorative bricks that are flush with the main wall. They are usually a slightly different length from other bricks in the wall.</td>
</tr>
</tbody>
</table>

Table 6.2 Decorative features for cavity walling
It is important to remember that with these decorative features the bricks are always cut flush with the inner face of the outer leaf. This is to ensure that the cavity is not bridged.

**Wall ties**

Wall ties are used to tie the walls together, or to stabilise them. They are generally made of a non-ferrous metal or stainless steel. The illustration in Fig 6.35 shows various types of ties that are used in cavity walling; all types have one thing in common, in that they are designed to trap the passage of water from the outer to the inner leaf (see Fig 6.36 on page 199). This is an essential requirement if the cavity is to function properly and keep the inside wall dry.
The wall ties must be placed close enough together to ensure that stability in the wall is maintained. Building Regulations require ties to be placed at distances not exceeding 900 mm horizontally and 450 mm vertically.

In practice it is found to be an advantage if the ties can be staggered.

As already mentioned, when cavity walls are being built it is essential that the wall ties are kept absolutely free from mortar droppings on completion of the walling; otherwise this can cause a bridge across the cavity which may allow water to pass across and cause the inner leaf to become damp (see Fig 6.38).

You can keep cavities reasonably clean and free from mortar droppings if you continually use cavity battens while raising the work. Beginning at the lowest part of the wall, a length of batten is placed on the first level of wall ties to catch the mortar droppings as the cavity wall is built to the next level of ties. At this stage the batten is carefully raised, the loose mortar is cleaned off and returned to the mortar boards, and the
batten is replaced on the new layer of wall ties. The same procedure is carried out at the level of the wall ties (see Fig 6.39). At the end of the day’s work, you should insert a long batten into the cavity and tap each of the wall ties to dislodge any mortar which may have fallen on top of them.

![Figure 6.39 Method of keeping a cavity wall clean during construction](image)

In a similar way, the bottom of the cavity should be kept clean. This needs to be done while the wall is built, so cleaning holes should be provided at frequent intervals in the first course of the fair work above the cavity filling; this allows the cavity to be thoroughly cleared of mortar droppings. These holes are filled in by brick inserts after the wall is completed. If the mortar droppings are allowed to rise above the damp-proof course, the rising damp may penetrate the inner leaf and also the flooring, which may be the prime cause of dry rot in a timber floor (see Fig 6.40).

![Figure 6.40 How moisture can penetrate to the inner leaf and cause damage to the timber floor](image)

**Working at height**

When you are working on cavity walling it may be impossible to avoid working at height. At all times you should use equipment and safeguards and any equipment that might minimise the distance that you could fall.
Ladders can be used but should generally be your last option. Mobile elevating work platforms, which can easily be moved around, provide very safe access when carrying out high level work.

If a Health and Safety Executive inspector visits a site they will be looking to see that:

- the right risk control measures are in place, including risk assessments carried out
- anyone working at height has access to the correct equipment and that they are actually using it
- anyone working at height is competent enough to be using the equipment
- any equipment is regularly being inspected and maintained.

Above all, every employer has a duty of care to look after the health and safety of anyone while they are at work.

**FORMING OPENINGS IN THE CAVITY WALLING TO THE GIVEN SPECIFICATION**

**Setting out**

Typically openings in cavity walls are created so that it is possible to fix doors and windows, or perhaps as a decorative feature in part of the wall.

The door and window openings are created during the construction of the cavity wall. Generally door and window frames can be either:

- fitted as the work on the wall is underway, so a frame is actually built into the walling
- created after the wall has been built by cutting the opening.

**Forming openings in cavity walling**

Frames act as profiles, which mark the opening that is required in the walling. These are plumbed shapes and squared off. They are held in position and the wall is then built around the frame.
The alternative is to fix built-in frames as the courses of brick are being built. These frames have **heads** and **sills**, which are longer than the actual width of the frame. These additional lengths are known as horns. They are trimmed and shaped to ensure that the facing bricks cover the head.

The frames are held in place using either metal cramps or wooden pads.

**Metal cramps**
Metal cramps are fixed onto the back of the frame. The cramp is positioned so that it is in line with a horizontal joint in the brickwork. This means that bricks are then laid on top of the cramp.

**Wooden pads or slips**
Pads are 90 mm square pieces of timber that are 10 mm thick. These are also placed so that they coincide with a horizontal brickwork joint. The pads are put in every four to six courses.

These pads are useful as they allow the frame to be put in later.

**Bridging openings with steel and concrete lintels**
Lintels support the load above an opening. Lintels can be made from a variety of different materials:

- **Timber** – these are more traditional and made from a solid beam.
- **Stone** – another more traditional material comprising of a solid block.
- **Reinforced concrete** – a more modern alternative.
- **Steel** – made from galvanised material.

The following point about lintels should be noted:
- **Concrete and steel can be combined and can support an enormous weight.** This allows the construction of large openings.

A lintel has to be capable of supporting the load placed on it. It must not bend or deflect that load. In the past, when smaller windows were used in older houses, wood was an acceptable material for a lintel. But over time wooden lintels become weaker due to rot and to warping.

Stone lintels are also only really strong enough for relatively narrow openings. In many houses where stone lintels can be seen they are in fact supported by galvanised steel.

It is possible to use brick lintels, but these are considered to be non-load-bearing. They are must be supported by a steel lintel if they are to be load-bearing. Bricks are ideal if a shaped arch in an opening is required.

In most modern buildings concrete that has been reinforced with steel tends to be used. The steel reinforcement is positioned approximately 25 mm from the bottom of the lintel. There are many different types of concrete lintel that are designed to match particular brick or blockwork or wall thickness.
For larger openings pre-stressed lintels can be fitted. These have wire strands that have been set into the concrete under tension.

Galvanised steel lintels are also widely used. They are comparatively lightweight. Large openings are fitted with heavyweight rolled steel joists, more commonly known as RSJs.

Brick and proprietary sills

Sills are designed to encourage rainwater to fall away from the wall below the opening. Windows and doors have sills.

Cavity walls have what is known as a closer block, which is bedded in below the inner window board. This provides a strong base for the window board. Traditionally window sills would have been wooden. Brick-on-edge sills can be fitted underneath the wooden window sill to make sure that all of the water runs away from the window frame. This also prevents the wooden window sill from rotting.
5. BUILD A CAVITY WALL WITH JUNCTION ATTACHED BY FIXINGS

OBJECTIVE

To build a section of cavity wall with a junction attached with wire mesh bonded into the bed-joints on one pier and an attached fixing to the other.

This method can be used when the block type differs from those used in the cavity leaf, to reduce the risk of cracking. It also removes the risk of poorly filled joints that can occur if indents are used.

Ensure you select PPE appropriate to the job and site where you are working. Refer to the PPE section in Chapter 1.

TOOLS AND EQUIPMENT

- Brick trowel
- Lump hammer
- Bolster chisel
- Spirit level
- Builder’s square
- Mesh reinforcement
- Wall starter
- Block/pins and line
- Straight edge
- Jointing iron
- Steel tape measure
- Boat level

Step 1: Follow Steps 1 and 2 of the practical task, Build a cavity wall with party wall junction, on page 185.

Step 2: Build the brick leaf to three courses high to make the setting out of the block leaf easier.

Step 3: Repeat the setting out procedure with the blocks so that the block leaf is also 2,240 mm long and directly opposite the outer leaf with the correct sized cavity.

Figure 6.43 Cavity wall with fixings and mesh model
PRACTICAL TIP
Check the blocks for upright with a level on the first course as this will make plumbing of further courses easier.

STEP 4 Build up the block corners with the ties placed in the correct position. Where the block wall will incorporate the mesh for the junction, build the mesh in as the wall is constructed.

STEP 5 Run in the block walls to full height with the line.

STEP 6 Attach the insulation in the correct staggered fashion and attach with the appropriate clips. Appropriate clips are normally supplied with the wall ties or insulation, as different manufacturers have different ones.

STEP 7 Repeat on the brick leaf by building small corners and run the courses in to the line.

STEP 8 Build the mesh into the wall to take the attached wall, making sure that the mesh is fully bedded into the mortar beds, preferably to the full width of the block leaf, and checking it for square.

PRACTICAL TIP
Although the blocks can be cut to maintain bonding on alternate courses of the junction, they will not be stronger than the blocks will be if left uncut. Therefore they can be stack-bonded without affecting the strength of the pier.

STEP 9 Mark the position and then fix the wall starter with the correct fittings supplied, making sure that it is secure, plumb and runs in line with the middle of the pier.

STEP 10 Lay the first block, check for square and then build the pier with the ties correctly slotted into position.

STEP 11 Apply a half-round joint to the brickwork and finish the blockwork with a flush joint.

6. BUILD A CAVITY WALL WITH A ROUGH RING SEMI-CIRCULAR ARCH

OBJECTIVE
To construct a semi-circular arch formed from brick and block cavity construction.

In a rough arch like this one, the curve is formed by the joints being shaped to form the arc rather than the bricks themselves being shaped.

Ensure you select PPE appropriate to the job and site where you are working. Refer to the PPE section in Chapter 1.

TOOLS AND EQUIPMENT
- Walling trowel
- Lump hammer
- Bolster chisel
- Spirit level
- Corner block/pins and line
- Builder’s square
- Straight edge
- Jointing iron
- Adjustable bevel
- Steel tape measure
- Compass dividers
- Scutch hammer
- Timber arch former and support wedges
**Step 1** Follow Steps 1 to 4 of the practical exercise, Build a cavity wall with party wall, junction on page 185.

**Step 2** Build three courses of bricks and one course of blocks, adding ties as required until the height has been reached for the arch opening to be added.

**Step 3** With the opening width established, add the next three courses of bricks and one course of blocks to reach the springing point of the arch.

**Step 4** Position the arch centre in the opening and adjust it to the correct height with blocks or bricks placed under it. Finally use wooden wedges to make any fine adjustment to get the centre level in both directions. Make sure that the face is plumb and does not protrude past any subsequent brickwork that is to be laid.

**Step 5** Build the brick corners up as high as possible, with allowance for the bricks that are to go around the arch.

The measurements required are:
- Length of wall 2,240 mm
- Height of wall 1,050 mm
- Width of cavity 300 mm

![Diagram showing cross section through cavity wall with a rough ring semi-circular arch](image)

**Figure 6.44** Cross section through cavity wall with a rough ring semi-circular arch

**Figure 6.45** Using the arch centre
**STEP 6** Mark the centre of the arch and place a key brick over this mark. There should always be an odd number of bricks in each ring.

Use the compass dividers to gauge the spacing of the bricks over the edge of the centre and mark with a pencil when an even spacing has been obtained.

**PRACTICAL TIP**

Start with small spacing on the underside and open the spaces up as required to help avoid large joints over the arch. Mark the spaces in from either end towards the centre.

**STEP 7** Start adding the snapped headers (rough cut half bricks) to the marked lines and shape the joints to maintain the bricks’ accuracy over the arch. Maintain alignment with the line across the face.

**PRACTICAL TIP**

Work from each side of the arch towards the centre before adding the cuts over the arch, rather than trying to cross the arch in one go. Make sure they are cut accurately to avoid problems when closing the cavity.

**STEP 8** Cut the bricks over the arch by allowing for a constant 10 mm joint over the arch bricks. Cut roughly to shape with a hammer and bolster and then finely trim with the scutch hammer.
**PRACTICAL TIP**

It is easier to mark the bricks to be cut if they are cut slightly larger in order to fit in the right place to be marked and then trimmed further. Allow for 10 mm all around, with extra along the cut edge to allow for trimming.

**STEP 9** Once clear of the arch, continue building the brickwork until the finished height has been reached.

**STEP 10** On the blockwork side, build the corners up while allowing for the cut bricks to be added that will eventually close the cavity.

**STEP 11** Cut a length of 150 mm DPC to be placed between the brick inner and the outer leaf of the arch.

Using the line to maintain alignment, start laying three-quarter bricks over the arch centre on the inner leaf. Make sure that you put a mortar joint between the brick and the DPC so as not to puncture it.

**STEP 12** Fill in the cut blocks to the remainder of the block leaf. Remove the timber arch former.

Figure 6.50 The finished wall

Figure 6.51 Another example (1)

Figure 6.52 Another example (2)
### Objective

To construct a rough segmental arch.

This means that the bricks over the arch are not shaped and it is the forming of the joints that allows the arch to be shaped correctly.

Ensure you select PPE appropriate to the job and site where you are working. Refer to the PPE section in Chapter 1.

### Tools and Equipment

- Brick trowel
- Lump hammer
- Bolster chisel
- Spirit level
- Block/pins and line
- Builder’s square
- Jointing iron
- Adjustable bevel
- Steel tape measure
- Compass dividers
- Timber arch former and support wedges

### Step 1

Follow Steps 1 to 4 of the previous practical exercise, Build a cavity wall with a rough ring semi-circular arch, on page 206.

### Step 2

Build the brickwork corners up as far as possible while allowing for the bricks that need to be cut for the skewback.

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**Figure 6.53** Cross section through cavity wall with a rough ring segmental arch

**Figure 6.54** Levelling the centre
**STEP 3** To form the skewback, place a brick at the end of the arch former and using an adjustable bevel, set the angle. Transfer this to the brick that will form the skewback with a pencil, then cut and lay it.

**PRACTICAL TIP**

Use 10 mm packers to position the brick to be cut at the right height.

**STEP 4** Follow Steps 6 to 12 of Build a cavity wall with a rough ring semi-circular arch (pages 207–8).

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Figure 6.55  Forming the skewback

Figure 6.56  Forming the skewback

Figure 6.57  Filling in bricks to make the arch

Figure 6.58  Marking curve on a brick to cut

Figure 6.59  Insert DPC and weep holes
Figure 6.60 The finished wall

Figure 6.61 The finished wall: front

Figure 6.62 The finished wall: back
1. In a cavity wall what creates a barrier for water?
   a. Outer wall
   b. Inner wall
   c. Window
   d. Cavity

2. What are the two ratings used for engineering bricks?
   a. A and B
   b. A and C
   c. A and D
   d. B and C

3. What is the object that is placed above the opening of a wall to support brick or blockwork above it?
   a. Jamb
   b. Sill
   c. Lintel
   d. Block

4. How many bricks are there over an air brick and liner?
   a. 1
   b. 2
   c. 3
   d. 4

5. What is the minimum width of a cavity according to Building Regulations?
   a. 50mm
   b. 75mm
   c. 450mm
   d. 900mm

6. Which of the following is used for insulating cavity walls?
   a. Mineral wool
   b. Beads or granules
   c. Insulation foam
   d. All of these

7. What sort of decorative feature can be described as being a course of cut bricks laid at 45° to the main face of the wall, which appear to be triangular in shape?
   a. Dentil
   b. Band
   c. Quoins
   d. Dog tooth

8. What are wall ties made from?
   a. Iron
   b. Wood
   c. Non-ferrous metal or stainless steel
   d. Concrete

9. To what depth should you rake out joints before pointing?
   a. 12 to 18mm
   b. 10 to 12mm
   c. 12 to 25mm
   d. At least 25mm

10. What is the upper part of a window or door frame called?
    a. Jamb
    b. Sill
    c. Rebate
    d. Head