As a bricklayer, always remember:

- you are bound to comply with the mortar specified by building regulations and specifications;
- no chemical additives are permitted as a substitute for lime, except in damp courses where much stronger mixes must be used.

The main causes for weak mortar are:

- not enough cement;
- the wrong use of additives and additional to excess amounts of some colouring pigments;
- insufficient mixing time.
  - — Even when the correct amounts of ingredients have been used, if they are not thoroughly mixed together, the mortar could be too strong in some parts but weak in others.
  - — 3 minutes in a mixer is the absolute minimum to ensure adequate blending.

Batching of mortar can be done as follows:

- with a bucket;
- with a gauge box;
- with a marked loading hopper.

3.2.1 Bucket batching

A simple way of making sure correctly proportioned ingredients are used is to fill and count the appropriate number of buckets, e.g. 9 buckets of sand, 2 of lime and 1 of cement for a 1:2:9 composite mortar mix.

By using this method, the risk of ending up with an incorrect mix is avoided, and, provided it is thoroughly mixed, this mortar is as specified and unlikely to be the cause of weak brickwork.

3.2.2 Gauge box batching

A timber gauge box measuring 305 × 305 × 305 mm is filled and emptied into the mixer a number of times. Such a box, containing approximately 0.03 m^3 (= 1 cub ft) would be too heavy for one man to lift and too awkward to handle.

Most mixers have a capacity of 0.06 m^3 (2 cub ft) or 0.09 m^3 (3 cub ft).

A bottomless gauge box to suit the capacity of the mixer can be made and used as follows:

- Place the box on a reasonably level surface.
- Fill it with a shovel and strike it off level.
- Remove the box and shovel the sand into the mixer.

Using a marked bucket, the correct amounts of cement and lime can then be added.

TABLE FOR MORTAR MIXES								
MIXER CAPACITY	1:1:6 MORTAR			1:2:9 MORTAR			1:3 MORTAR	
	CEMENT	LIME	SAND	CEMENT	LIME	SAND	CEMENT	SAND
0.06 m^3 (2 cub ft)	14 kg	7 kg	0.06 m^3 (2 cub ft)	9.5 kg	9 kg	0.06 m^3 (2 cub ft)	28.5 kg	0.06 m^3 (2 cub ft)
0.09 m^3 (3 cub ft)	21 kg	10 kg	0.09 m^3 (3 cub ft)	14 kg	13.5 kg	0.09 m^3 (3 cub ft)	42.5 kg	0.09 m^3 (3 cub ft)

Suitable sizes for gauge boxes (internal dimensions):

0.06 m^3: 305 × 305 × 610 mm or 305 × 416 × 416 mm or 384 × 384 × 384 mm

0.09 m^3: 305 × 305 × 915 mm or 305 × 527 × 527 mm or 438 × 438 × 438 mm

NOTE:
Sometimes for better workability, 1/10 to 1/4 part of lime may be added. Maximum bond strength is achieved with a 1:(1/4-1/2):(4-4 1/2) mix.

3.2.3 How to make a cement or lime gauge

Assume you have to mix 0.09 m^3 of a 1:1:6 mortar.

From the table it shows that you need 21 kg of cement.

To make your cement gauge, proceed as follows:

- Place a plastic bucket on a scale and note its weight.
- Add cement until the scale reads 21 kg plus the weight of the bucket.
- Level the cement and mark the level round the inside or outside surface of the bucket.
- Label the bucket, e.g. 1:1:6 for 0.09 and use this measure to add one part of cement and one part of lime to each 0.09 m^3 (3 cub ft) of sand.
- Keep the bucket dry.

The proportions to be mixed are based on volume. Therefore having ascertained the volume of 1 part of cement for this mix, 1 volume of lime is also known. Having shovelled the measured amount of sand into the mixer, all that is needed now is one bucket of cement to the marked level and one of lime to that same mark for this 1:1:6 mix.

For a 1:2:9 mix, the procedure is the same. For instance for a 0.09 m^3 mix:

- Weigh 14 kg of cement in a bucket and mark the level as before.
- Label the bucket for this particular mix.

To make the mix, all that is now required is to add to the measured-out sand one bucket of cement filled to the mark and two buckets of lime filled to the same mark.

3.2.4 Hopper batching

Some larger mixers can be obtained with a loading hopper.

By tack-welding lengths of 6 mm rod on the inside of the hopper to indicate the level of say 0.09 m^3 (3 cub ft) of sand and using the appropriate gauge buckets as explained above, accurate batching is simplified. All that needs to be done is to shovel the correct amount of sand into the marked hopper, adding the correctly measured quantities of cement and lime, then tipping the hopper contents into the mixer.

NOTE:

Make a point of consulting trade publications and standards on this matter. It will ensure you keep up-to-date with trade requirements and trends. Ask your instructor when in doubt.

REVISION QUESTIONS

1 What are the basic ingredients of mortar?

2 What is the role the matrix plays in mortar?

3 Why is sea sand not a suitable aggregate?

4 What are the various types of mortar?

5 List the materials that can be used as a matrix?

6 What is the best sand to use as an aggregate for brick mortar?

7 Is cement mortar suitable for building a fire place? If not, what should be used?

8 Why should matrix material be stored dry and used fresh?

9 If proper pit and aggregate is not available, what could be used in its place?

10 What are the methods of batching mortar?

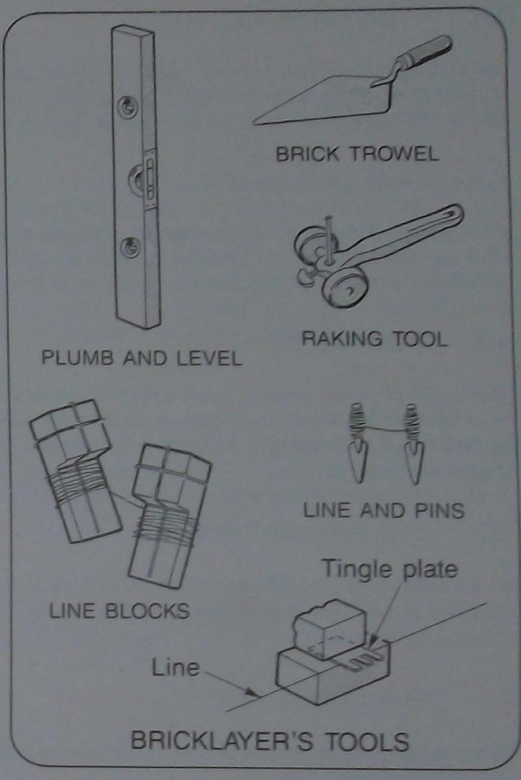
11 Why is it important to accurately measure out the mortar ingredients?

4 TOOLS AND EQUIPMENT

The essential tools used by a bricklayer are as follows:

4.1 THE BRICK TROWEL

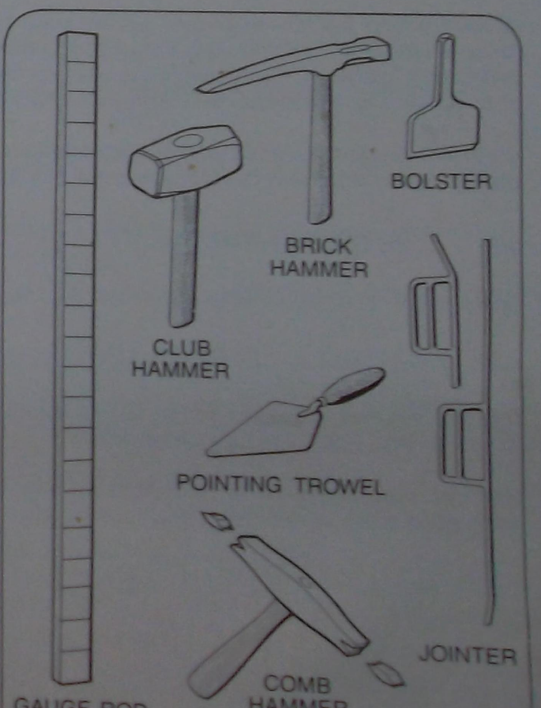
The selection of the trowel is most important for the operation of spreading mortar and laying bricks. Complete mastery of its use and correct manipulation is essential and it is only by constant practice that the necessary action of hand, wrist and arm will be acquired. The secret of good bricklaying is in the technique of spreading the bed. As the trowel is used along with the hand and eye skills, it is most important that selection of which shape is done with much thought and care. A trowel with a good built-in lift is all-important and necessary for ease of use. Trowels are produced by most manufacturers with built-in design considerations for right-handed and left-handed bricklayers.



BRICKLAYER'S TOOLS

4.2 THE SPIRIT LEVEL

This tool is used for checking the horizontal and vertical faces of brickwork to ensure the work is both level and plumb. Consideration must be taken with the size of the spirit level used in varied aspects of work. A short level would be an advantage when building a fireplace (small area, confined space). In return corner construction the longer spirit level will have a distinct advantage when plumbing or testing the alignment of the corner. The level can and is often used together with a timber or aluminium straight edge. Care should be taken with a spirit level and its accuracy should be checked regularly during a day's work. It should be stored in the shade when not required, and never left in the hot sun.



BRICKLAYER'S TOOLS

4.3 THE LINES AND PINS

Brick courses are laid to a line which is stretched taut between a pair of steel pins driven into the mortar joints. It is important that good quality line is used along with quality pins, these in turn will resist the damage caused by their use in strong mortar joints.

4.4 THE LINE BLOCK

Line blocks may either be purchased or made from quality timber scrap. The line block is used instead of a line and pins on the external corners so as to prevent damage to the mortar joints. Tension of the bricklayer's line holds the block in position at the required course.

4.5 THE TINGLE

The tingle or tingle plate is used with the line when constructing long walls. The tingle plate, supported by a brick or brick bat as shown, prevents the line from sagging or swaying in the wind. A tingle may be fashioned by looping a 200 mm length of line over the existing line and pulling it tight if further tingles are required.

4.6 THE RAKING TOOL

An adjustable pin or nail supported on two small wheels and used to rake out mortar joints to a specified depth. Some types may be purchased, but simple tools may be fashioned from hoop iron or timber and nails.

4.7 THE GAUGE ROD

This is a straight edge made from a piece of suitable timber that is seasoned, straight and of adequate length for the job.

Graduations to suit new brickwork, usually made by a saw cut, are marked on one or both widest faces at intervals. The bricklayer will need a number of these for use with the various sizes of bricks and blocks available. The gauge rod is used for checking and keeping brick courses at even multiples of bricks plus a mortar joint thickness throughout the job.

A general gauge may be 86 mm for brick and joint for new work, but for additions and restoration work, the bricklayer may have to follow the existing gauge of the previously constructed work.

4.8 THE BRICK HAMMER

This is used for rough cutting of bricks or as a hammer.

4.9 THE BRICK COMB OR SCUTCH HAMMER

This tool has slots cut in the end of the blades, into which combs may be fitted. These combs may be removed when worn, and then discarded.

This tool is much used by the bricklayer to rough cut or dress bricks to special shapes. It is used to great effect when constructing ornamental brickwork such as arches and fireplaces.

4.10 THE CLUB HAMMER

Used with most brick cutting tools such as chisels and bolsters.

4.11 THE BOLSTER

This is a flat broad chisel obtainable in a variety of blade widths. It is used with the club hammer to cut bricks accurately to a required shape or size. A blade width of 110 mm may be found to be an advantage when cutting half bricks required for bonding purposes. May be obtained with or without a rubber protective grip.

The head of the bolster, as with other types of chisels, should not be allowed to become mushroomed from excessive use. This burring-over must be ground off regularly so as to prevent damage to the hands and eyes.

4.12 THE POINTING TROWEL

This tool is used for pointing the mortar joints if they have to be struck as the work is being carried out. It is much smaller than the brick trowel. This tool would be used regularly for the pointing up of old fretted mortar joints in restoration work.

4.13 THE JOINTER

A tool usually made of steel with either a round or a shaped facing for the finishing of joints.

4.14 THE STEEL SQUARE

This tool is a large setting out square, which is 600 mm × 450 mm, and is used for setting angles and squaring 90 degree corners.

4.15 THE FOLDING RULE

This is a four-section folding rule, each section is 250 mm in length, and is normally carried in the bricklayer's pocket.

4.16 THE MASONRY SAW

A motor-driven abrasive wheel (or diamond impregnated saw blade) for making difficult or multiple cuts in bricks accurately. Most useful where hard bricks are concerned.

4.17 USE AND CARE OF TOOLS

Each tool is designed for its particular task and should have a long productive life, providing it is properly cared for and used for its set purposes. Using a level as a battering ram to straighten brickwork, or a trowel to cut wire or rods, is sure to reduce their span of usefulness.

Tools should be regularly cleaned and left ready for use, especially as mortar is much more easily cleaned off when it is still wet.

A bricklayer's tools are his livelihood so he should take care of them. A strong tool box large enough to accommodate all his hand tools is well worth the money invested. Tools left laying about will soon be lost and time spent looking for them costs time and money.

5 SCAFFOLDING

The erection of scaffolding is a specialist's job and it must be carried out according to stringent regulations in view of the safety aspects involved.

The scaffolding and working platforms are usually arranged in stages of 1.50 m. These stages should be so as to minimise fatigue which may result in a decrease in working safety, poor workmanship and slower output rate.

The scaffold should be strong enough to carry a load in excess of what it is ever likely to have to bear for obvious safety reasons. It is the employers' responsibility to provide suitable scaffolding for their workmen.

Modern scaffolding is usually constructed with tubular steel assembled with special screwed couplings which make it possible to assemble a variety of junctions.

Most forms of metal scaffolding are covered by patents and specialist firms carry out the scaffolding job as sub-contractors.

Provided the scaffolding required does not have to be used to a height exceeding a normal single-storey dwelling, bricklayers will often build their own scaffolding, but depending on local regulations, a certificate of competency may be required for this.

Scaffold erecting must be done according to the safety regulations and the appropriate assembling instructions for the type of scaffolding being erected.

Learn all you can about scaffolding and its safety requirements by:

- obtaining reading matter on the subject from scaffolding specialist firms;
- learning the names of the various parts of a scaffold;
- reading and studying the safety regulations related to scaffolding;
- helping to erect scaffolding on the job;
- enquiring about it from experts or from your instructor;
- preferably, obtain a certificate of competency yourself.

SAFETY:

Erecting scaffolding demands systematic and careful assembling to ensure the safety of those who have to work on the structure later.

Working as a bricklayer from scaffolding involves additional danger compared to working at ground level. At all times observe the safety requirements and make sure they are firmly implanted in your mind.

This means:

- proper location and securing of access ladders (see WORKSHOP SAFETY MANUAL);
- ensuring that boarding is properly located and cannot 'see-saw' on its supports;
- keeping boarding uncluttered, free of mortar droppings or broken bricks;
- wearing proper shoe wear and head protection gear.

6 BRICKLAYING TERMS

This section does not list all the terms used in bricklaying, but only those you will have to use in your basic training in the building of simple walls. Other terms used in the trade will be listed under their appropriate subjects.

ARRIS

This is the edge or angle formed by two meeting surfaces of a brick. A brick has 12 arrises.

BAT

This is the portion of a brick cut across its width which is greater than one quarter. Half a brick is called a half bat, a three-quarter brick is called a three-quarter bat.

In the metric modular bricks, use is made of the ⅓ and ⅔ fraction of a brick. This in combination with the size of the modular brick enables compliance with the 600 mm module or panel.

STRETCHERS

Bricks laid with the long side on the face of the wall.

HEADERS

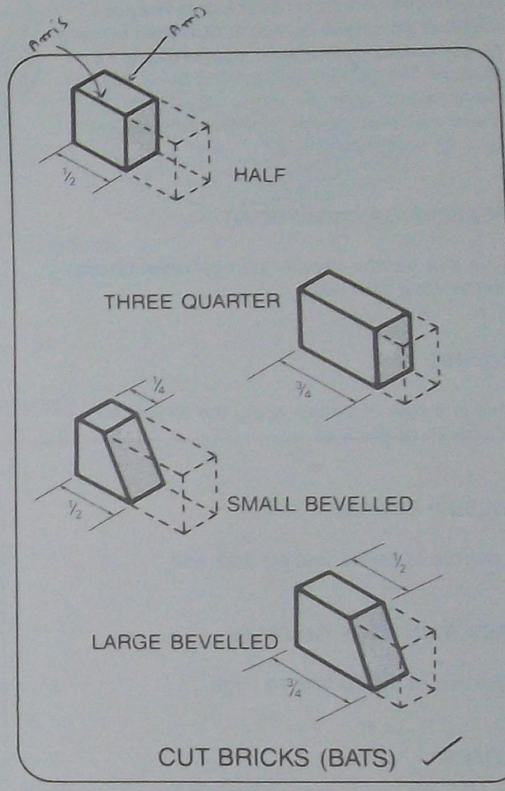
Bricks laid with the end on the face of the wall.

BED

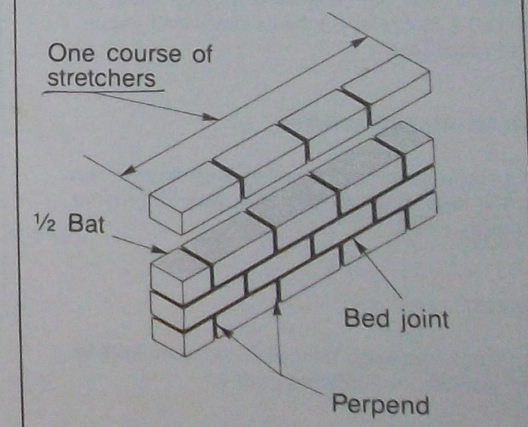
The bottom surface of a brick.

BED JOINT

This is the horizontal joint of mortar and it is usually 10 mm in nominal thickness unless otherwise specified.



CUT BRICKS (BATS)



STRETCHERS

STRAIGHT JOINT

This is a vertical joint running through two or more courses. Except for decorative work, such joints should be avoided as they are weak in bond and do not enable load bearing to be spread over a wide supporting area through the bond. Although the brick work in some cases does not show straight joints these can exist inside it, depending on the type of bond used.

PERPEND OR CROSS JOINT

This is a vertical mortar joint between bricks on the face of a wall.

COURSE

This is a row of bricks along the length and thickness of the wall.

SOLDIER COURSE

A course of bricks laid on their end.

BRICKS ON EDGE COURSES

A course of bricks laid on edge.

CLOSER

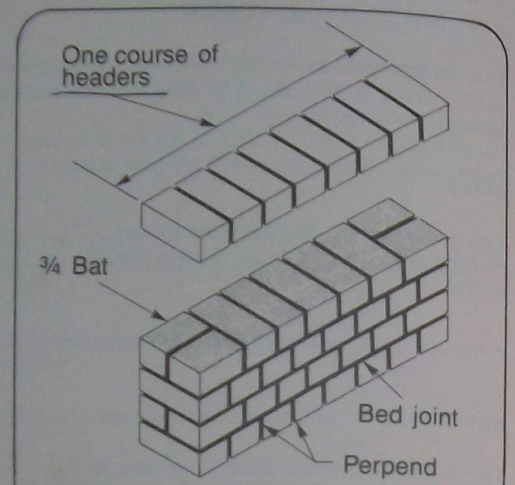
Correct bonding at corners, at returned ends and at stopped ends is important. For this, and to finish a wall to a vertical end face, a brick of less than standard width is used. It is called a closer and it has usually one uncut stretcher face.

SNAP HEADER COURSE

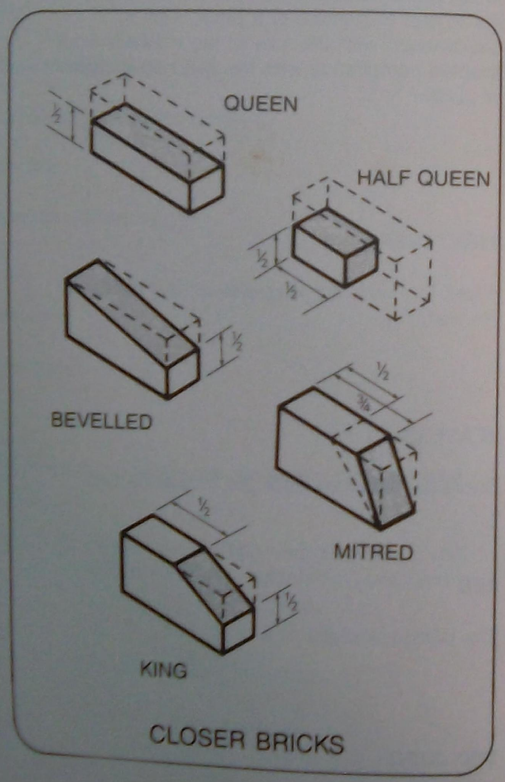
A course of ½ bats showing their header face in the face of a 110 mm thick wall (½ brick or ½ unit).

BOND

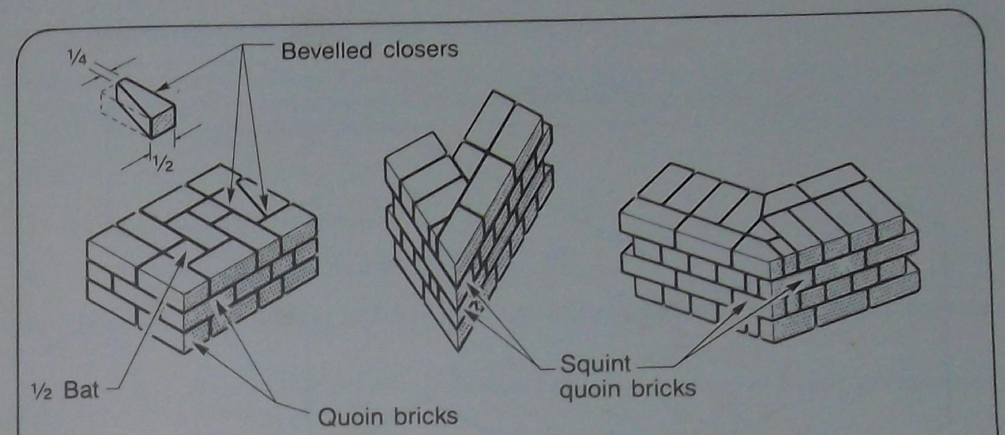
This is the arrangement of bricks overlapping one another in a definite pattern.



HEADERS



CLOSER BRICKS



QUOIN BRICKS

QUOIN

The vertical external angle of a wall is called a quoin.

QUOIN BRICK

One of the bricks forming the quoin.

SQUINT QUOIN BRICK

A corner brick with an exterior angle which can be greater or less than a right angle.

Where the corners of buildings or construction features within a building (e.g. bay windows) are not at right angles, the corner is described as being a squint.

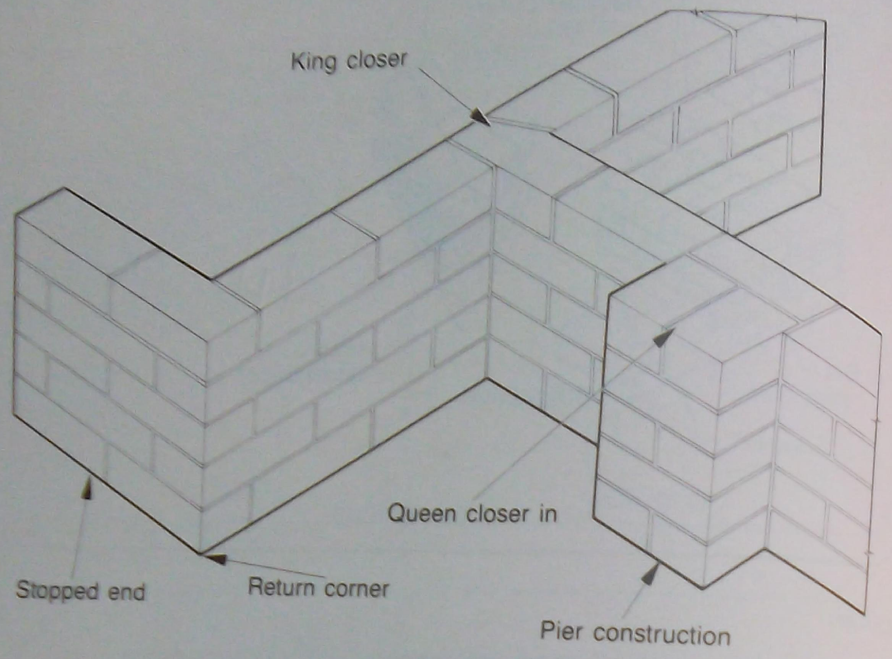
There are two classifications of squint quoins:

- Acute Squint.

  Where the angle of the corner is less than 90 degrees.

- Obtuse Squint.

  Where the angle of the corner is more than 90 degrees.



RETURNED AND STOPPED ENDS

CORNER OR RETURNED END

That section of the wall which changes direction.

STOPPED END

The end of a wall finished with a vertical face and not turning a corner.

There are several types of closers, the most commonly used being:

- The queen closer;
- The king closer;
- The bevelled closer.

7 PREPARATORY OPERATIONS TO BRICKLAYING

Before engaging in the practice of bricklaying proper, there are a few essentials to be observed and a number of manipulative skills to be acquired, all of which, through continuous observance and practice, will lead to the efficient performance of the art with the minimum of physical exertion.

These are:

- The laying-out of your working post.
- The one-handed manipulation of bricks.
- The efficient manipulating of the trowel in spreading mortar, buttering, cutting, bedding and trueing of bricks.

It is by continuously practising daily for a few minutes that you will eventually acquire the easy-going rhythm that typifies the expert bricklayer.

7.1 LAYOUT OF THE WORKING POST OR BASE

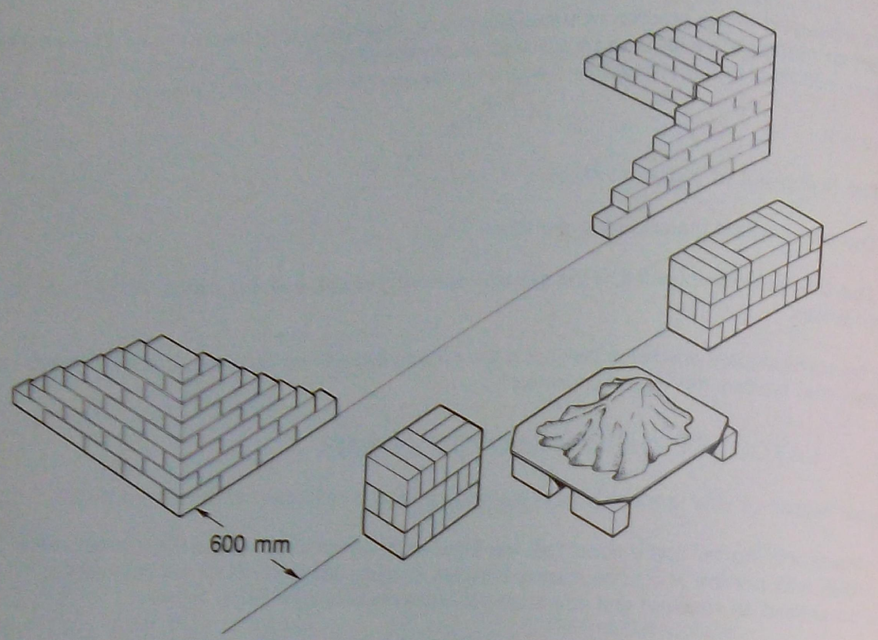
Proper layout of your working post is essential to avoid unnecessary movements and fatigue.

- Place the mortar board about half-way between the length of the wall portion you are to cover. This wall portion should be roughly 2 metres at a time and therefore the mortar board will have to be shifted as required and new stacks of bricks made on either side.
- Place stacks of the necessary bricks at either side of the board as shown.
- Leave a distance of some 550 mm between the wall to be built and the bricks and mortar board so that you have completely free access to the wall at all times.

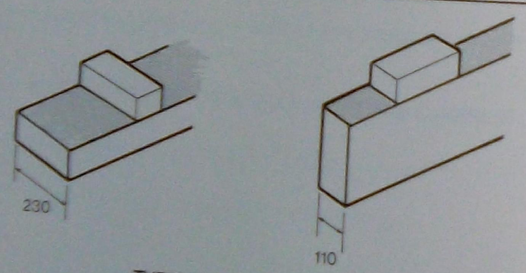
SAFETY

Bricks are heavy and have sharp edges and corners. A brick being dropped from a small height can inflict severe injuries.

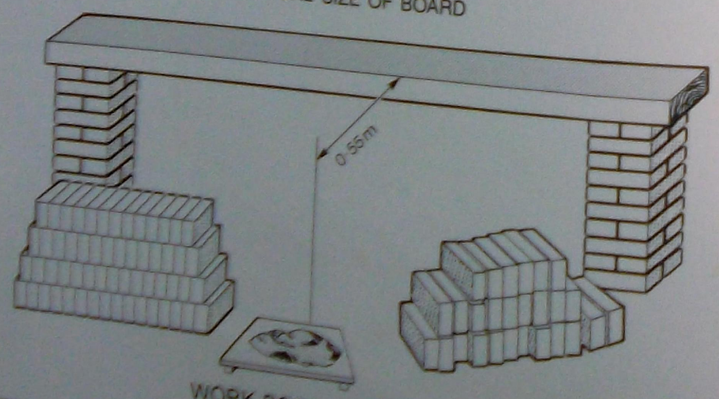
WEAR SUBSTANTIAL WORKING BOOTS OR SAFETY BOOTS AT ALL TIMES WHEN WORKING WITH BRICKS.



LAYOUT OF THE WORKING POST



TYPICAL SIZE OF BOARD



WORK POST ARRANGEMENT

7.1.1 Elevated work base

The illustration shows a working base which consists of a solid timber board resting on two piers built of 10 courses of bricks, without mortar, placed on level ground.

The width of the board should equal one stretcher of a standard brick (230 mm) and its thickness should be equal to one header (110 mm).

Overall length: 2 metres.

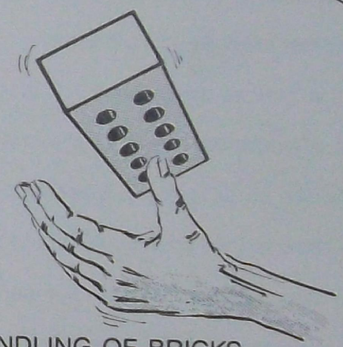
For training purposes, such a layout has advantages over starting work at floor level:

- It is flexible in that it can be put anywhere a reasonable piece of level ground is available.
- As the trainee becomes more adept, the level at which the work is being done can be gradually lowered and, in this way, unnecessary fatigue is avoided in the initial training stages.
- It is an effective means for practising the spreading of mortar bed joints for ½ and 1 unit thickness brickwork by using the board thickness and width respectively.

7.2 HANDLING THE BRICK

No two bricks in any stack are exactly alike and neither are any two stretcher or header faces of any brick alike. Yet it is important for the appearance of the work that the best possible surface is shown on the outer face of walls. Therefore, the best face of each brick must be selected before laying it. After much continuous practice, the expert bricklayer acquires a rhythmic sequence of:

- Spreading mortar with the trowel in one hand.
- Picking up a brick with the other hand.
- Selecting the best face of the brick by co-ordination of hand and eye by tossing and turning the brick gently in one hand.
- Finally laying the brick accurately using the brick hand and the trowel hand at the same time.



HANDLING OF BRICKS

Constant practice in this and the acquiring of the proper stance are necessary for gaining of proficiency and the performance of work with the least possible fatigue.

Your instructor will show you how all this is done. Make a point of practising the brick tossing for a few minutes each day until, after a while, it becomes almost second nature. Also practice the rhythmic sequence in the same way, and always during such practice periods be sure to have the trowel in your trowel hand. Follow closely your supervisor's instructions at all times.

NOTES FOR THE INSTRUCTOR

Show the trainee how the brick is picked up with one hand.

Show him how to manipulate the brick so that the right face is lined up prior to laying the brick.

Show the trainee how the brick would be placed on the mortar (no need to have mortar at this stage).

Make sure the trainee has the trowel in his trowel hand. This is to get him accustomed to the actual working station.

Watch the body stance of each trainee as he practises:

- his back should be bent as in the actual bricklaying position;
- his knees must be straight when he goes through the motions of laying a brick.

Such practising is very tiring for a beginner and, while it is necessary, it should not be done for more than a few minutes at a time.

Preferably use dry bricks to avoid the development of sores on the hands. For this exercise, use a working post as described in 7.1.

7.3 HANDLING THE TROWEL

One of the difficulties you meet in learning this trade is the correct spreading of mortar. To arrive at this, correct manipulation of the trowel must be learned. The art lies in a supple movement of the wrist and can only be acquired with much practice.

For this exercise you will need:

- a base as described at 7.1, unless a permanent base already exists in the practice room;
- a mortar board with mortar of the correct consistency.

The aim of the exercise is to learn:

- how to fix mortar on the board before picking it up;
- the correct consistency the mortar should have;
- how to pick it up and spread it with the trowel in the correct manner;
- how to handle the trowel correctly.

Having set up the base board with its widest face up on two 10-course piers of bricks, the instructor will demonstrate how the exercise is to be done. Watch him closely and when told to do so proceed with the exercise imitating your instructor as closely as you can.

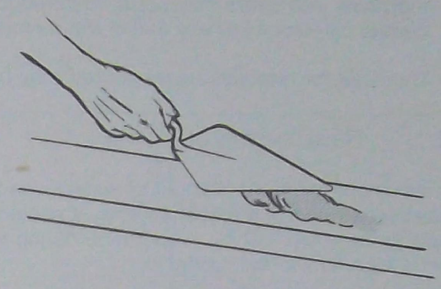
Imagine the base to be top of a wall 1 brick unit wide.

- Stir up a small amount of mortar on the board.
- Pick up mortar from the board with the trowel.
- Lay the mortar on top of the base board by tilting the trowel inwards (towards you) and let the mortar slide off the trowel.
- At the same time move the trowel along slowly until empty.
- Repeat this until there is enough mortar to lay some 4 bricks in stretcher course.
- With the tip of the trowel draw a furrow through the mortar where the brick centre lines will be, using a vibrating movement of the hand.
- Remove excess mortar from the side of the base board.
- Repeat the sequence until the base is filled.

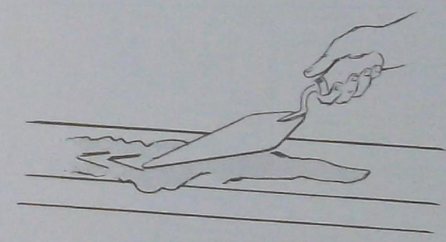
Constant practice is necessary to develop the hand and eye to obtain a proper mortar bed which will be of the correct thickness without the need to remove excessive amounts of mortar when the brick is pressed into its bed joint.

After a few such exercises, tilt the base on its narrow side and repeat the exercise for a ½-unit width of mortar bed joints.

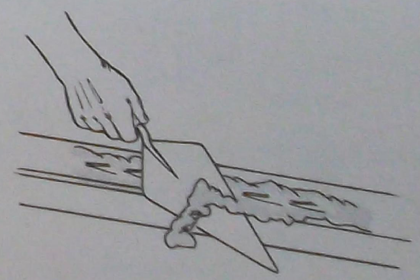
As experience is gained, gradually lower the height of the base board until it is only 3 courses high.



LAYING THE MORTAR



FURROWING



REMOVING EXCESS MORTAR

NOTES FOR THE INSTRUCTOR

- In the initial practice sessions, there is a need for constant and patient observation of the trainees to guard against the acquisition of bad working habits, posture and the making of unnecessary movements.
- Individual instructors may prefer to introduce, at this stage, actual bricklaying to help in obtaining correct full-joint thickness and in the removal of excess mortar.
- The need for retempering the mortar may be introduced at this stage also.

7.3.1 Retempering of mortar

For maximum bond, the amount of water used for mixing should be just short of the amount which causes separation of the components. It should be maintained at that level by retempering; that is, replacing the water lost by evaporation during the first two hours after the initial mixing in order to retain a high flow in the mortar.

NOTES

7.4 THE CUTTING OF BRICKS

Bricks may be cut by any of the following:

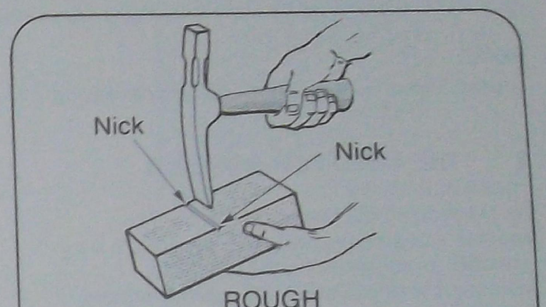
- The brick hammer.
- The club hammer with bolster or chisel.
- The comb hammer or scutch.

7.4.1 The brick hammer

The cutting edge of this hammer is used for rough cutting.

- The brick is nicked on the edges at the proper place.
- A sharp blow of the hammer's cutting edge between the two nicks.

CAUTION:
Watch your feet as the bat drops.

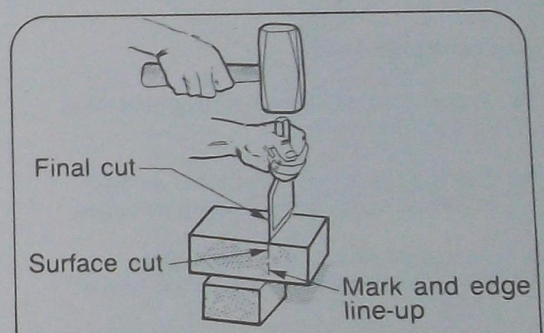


ROUGH
CUTTING WITH BRICK HAMMER

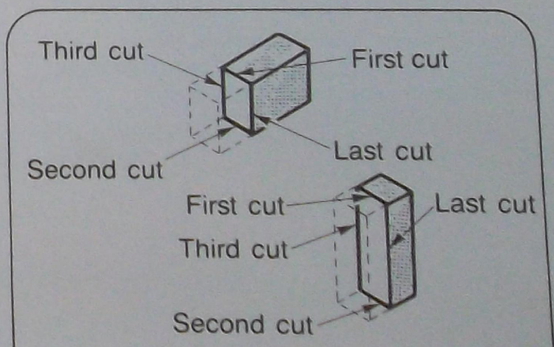
7.4.2 The club hammer and bolster

These are used for accurate cutting of bricks. Adopt the following procedure:

- With chalk, mark the line of cut on all faces of the brick.
- Supporting the brick on the ground by another brick or suitable support as shown, make the first two cuts on the short sides of the brick by a sharp but not too heavy a blow on the bolster.
- Make another cut on the long side of the brick in a similar fashion.
- Turn the brick over, line up the mark and the edge of the support, then with a sharp blow on the bolster, cut the brick at the required location, preferably on the brick face that will be shown in the wall face.



ACCURATELY CUTTING BRICKS



CUTTING SEQUENCE

CAUTION:
Chips can fly up when cutting hard bricks with bolster or chisel. Wear goggles when cutting bricks.

7.4.3 The comb hammer or scutch

Used for dressing the brick to a desired shape after being rough cut with brick hammer or club hammer and bolster. Used by the bricklayer when constructing ornamental brickwork such as arches or curved walls. Must be used with sharp comb blades for best effects.

NOTE:
A scutch hammer cannot be used on hard burnt clay bricks.

8 THE NEED FOR BONDING

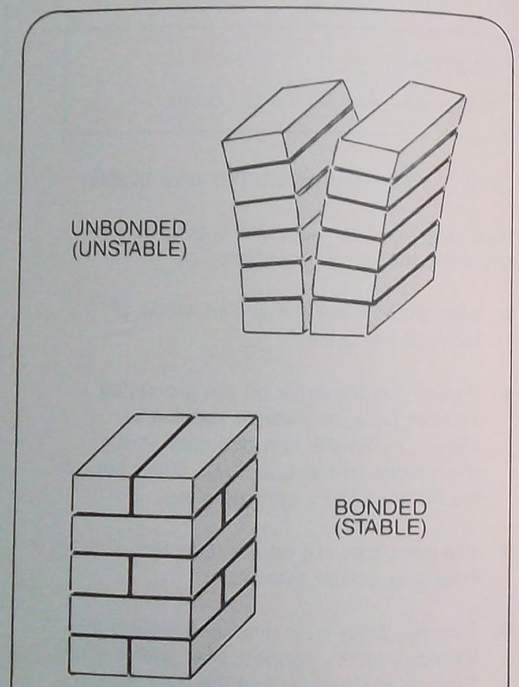
By stacking single bricks on top of one another and side by side, as illustrated, a very unstable arrangement is the result. By stacking the bricks in an interlocking pattern, the arrrangement becomes far more stable.

Where brick work is concerned, the bond is the arrangement of bricks overlapping one another.

The bond provides for:

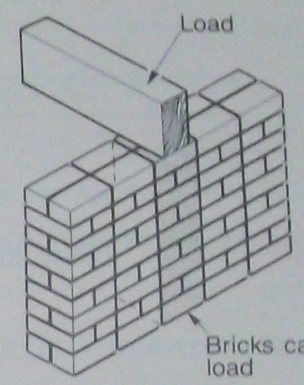
- Proper load distribution through the mass of the brick work.
- The tying together of the mass so that individual bricks are not easily dislodged.
- Some uniform and pleasing pattern arrangement of the bricks on the face of a wall.

There are a variety of bonds in use and they can be distinguished by their differences in the brick work face. In walls of greater thickness than ½ a unit, the bond must be arranged across the width of the wall (longitudinally). This is to ensure the maximum possible strength in both directions and to give proper load distribution.

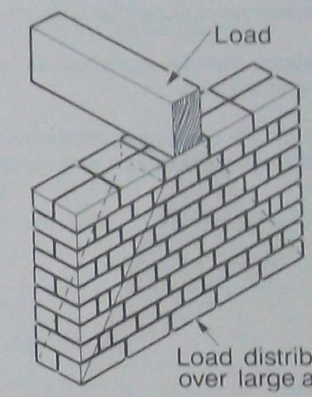


THE NEED FOR BONDING

The illustration shows the differences in load-bearing capacity between a wall bonded across its width only and one which is bonded across its width as well as longitudinally. The latter giving maximum strength and distribution of the load over a larger area.



WALL BONDED ACROSS THE THICKNESS ONLY (WEAK CONSTRUCTION)



WALL BONDED ACROSS THE THICKNESS AND LONGITUDINALLY (STRONG CONSTRUCTION)

STRENGTH OF BRICKWORK

8.1 THE PERPENDS (VERTICAL JOINTS)

The aim of this exercise is to accustom the trainee to work with bricks and mortar simultaneously and to acquire the necessary skills to overcome the difficulties associated with this as well as those involved in the placing of a brick into mortar and the making of a perpend. Through this the trainee will learn how to lay a first course and to make regular perpends.

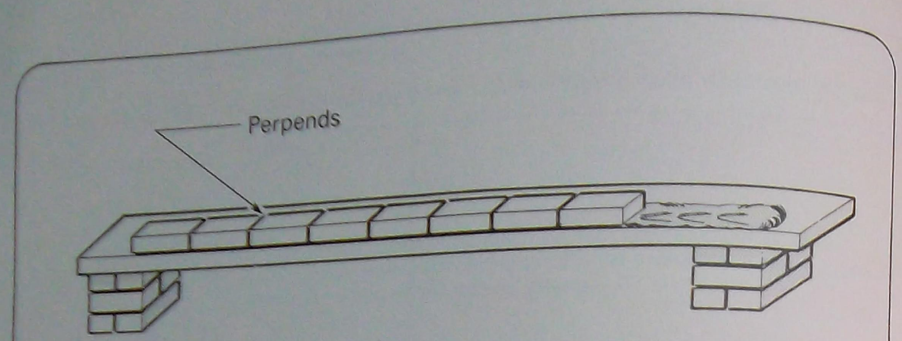
8.1.1 Material requirements

One base board as for the exercise at 7.3.1 (if no permanent base is available).

One mortar board with mortar, small amount of bricks (standard).

8.1.2 Preparation

Where no permanent base exists, mount the base board on two 3-course piers as shown and organise the work post in the normal way; bricks and mortar close at hand.



PERPENDS IN A STRETCHER COURSE

8.1.3 Basic technique — to trace a bond

This skill is used by a bricklayer to determine the number of full-size stretcher brick faces and perpendicular mortar joints there would be in a given wall length.

Starting from point A or quoin end, the bricklayer leap-frogs two selected dry bricks to a predetermined point along that wall until he reaches a given point (from point A to point B).

This technique must be applied so as to have a wall containing full bricks with no irregular pieces in the middle of the wall.

When this task is completed, bricks may be laid on the quoins and the wall length run in following normal bricklaying operations with mortar bed and perpend joints.

8.1.4 Exercise No 1

This consists of laying a stretcher course of 8 bricks into a bed of mortar and working from left to right.

The instructor will demonstrate the sequence of the procedure. Watch him closely then proceed as follows when told to do so:

- Lay and spread on the base sufficient mortar to accommodate 8 bricks.
- Keeping the trowel in one hand, pick up a brick with the other, select the proper face.
- Place the brick into the mortar and bed it down with the hand and fingers.
- Level the brick with bent fingers and if necessary by one or more gentle taps with the side of the trowel.
- Remove excess mortar which exudes from the bed joint.
- With your free hand, pick up another brick, select the best face.
- Butter the perpend which will be next to the header face of the brick previously laid.
- Place the brick like the first one, line it up with the first one and gently tap it into place. Remove the excess mortar.
- Repeat the process for the remaining 6 bricks, adding mortar to the base as necessary.

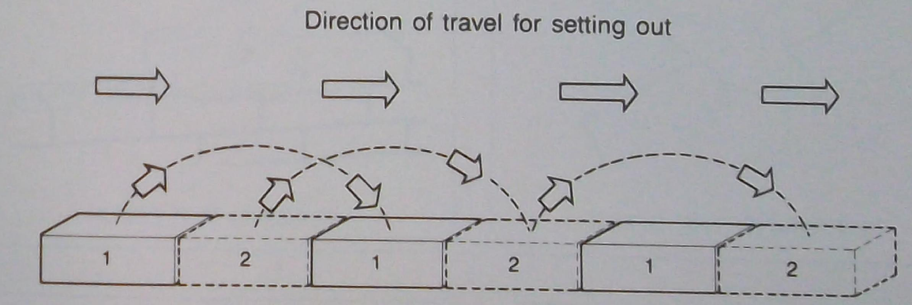
Now measure the length of the course you have laid and note it.

NOTE:

Buttering the perpend can be done in two ways:

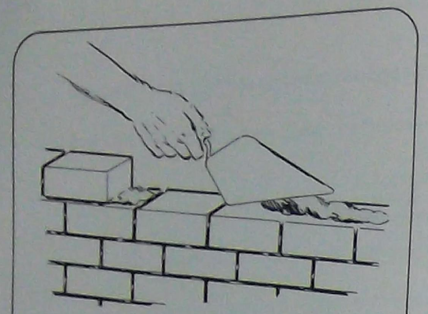
Either butter the left-hand perpend of each brick after the first, or

Butter the right-hand face of the first brick and all subsequent ones except the last one before laying the brick.

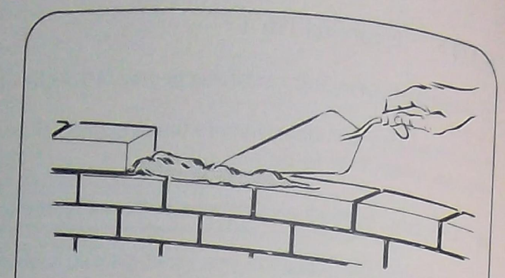


LEAP FROG THE BRICKS

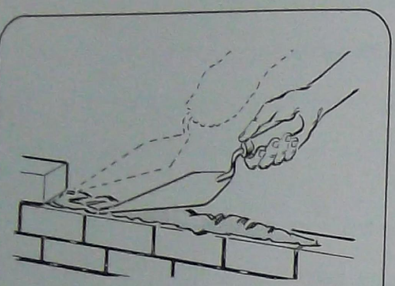
BASE OR FIRST COURSE SET OUT DRY (NO MORTAR)



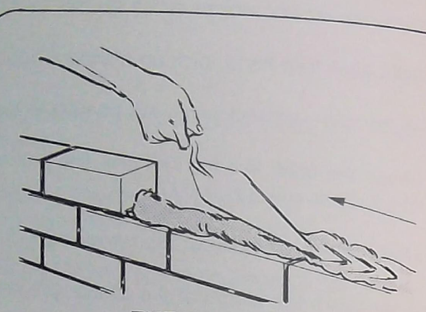
LAYING THE MORTAR



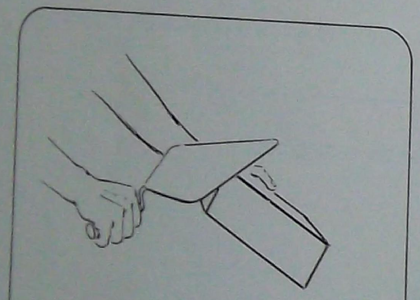
LAYING THE MORTAR
(ALTERNATIVE METHOD)



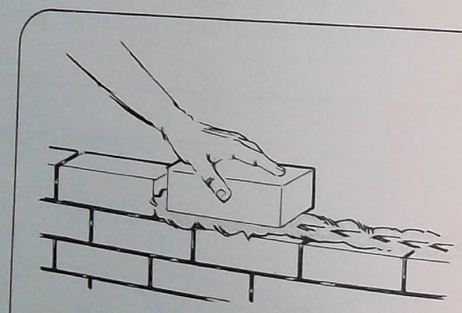
FURROWING



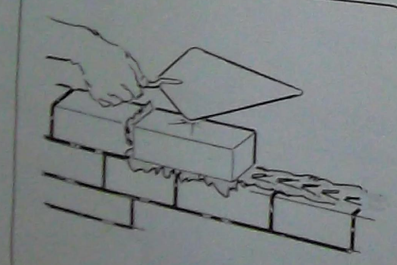
FURROWING
(ALTERNATIVE METHOD)



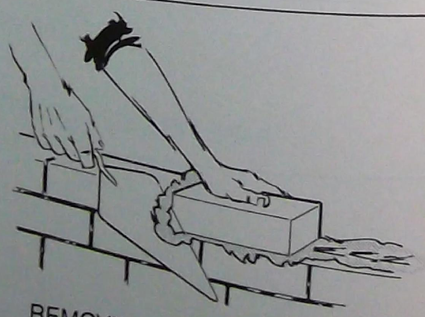
BUTTERING THE BRICK



PLACING THE BRICK



TRUEING THE BRICK



REMOVING EXCESS MORTAR

NOTES FOR THE INSTRUCTOR

Emphasise again the need for a properly laid out work base to avoid unnecessary movement by the trainee each time he lays a brick.

Demonstrate how the brick is placed, bedded in and levelled into the mortar bed, how the brick is buttered and so on. If necessary, split the whole sequence into separate distinct motion sequences, remembering that what the expert can do without thinking requires a great deal of concentration from the beginner.

Do not allow trainees to handle bricks with two hands and insist that they have a trowel in the hand at all times.

Emphasise the need for full joints.

Do not insist on regular perpends or the horizontal line-up at the first exercise.

Discuss with the trainees the need to adopt standard joint dimensions after having measured with them the lengths of the 8 brick course laid by the individual trainees.

NOTES

8.1.5 Exercise No 2

- Using a straight piece of timber, dressed all round and of the general dimensions shown in the illustration, mark in pencil on one edge 17 lines at 120 mm distance of one another and on the other edge 8 lines at 240 mm centres as shown.
- With a thin saw, accurately make cuts on the pencilled lines. These cuts need not be deep, only just sufficient to be clearly visible.
- Remove any splinters which may have occurred with sandpaper.
- With an indelible ink, neatly write the identification markings on the gauge.

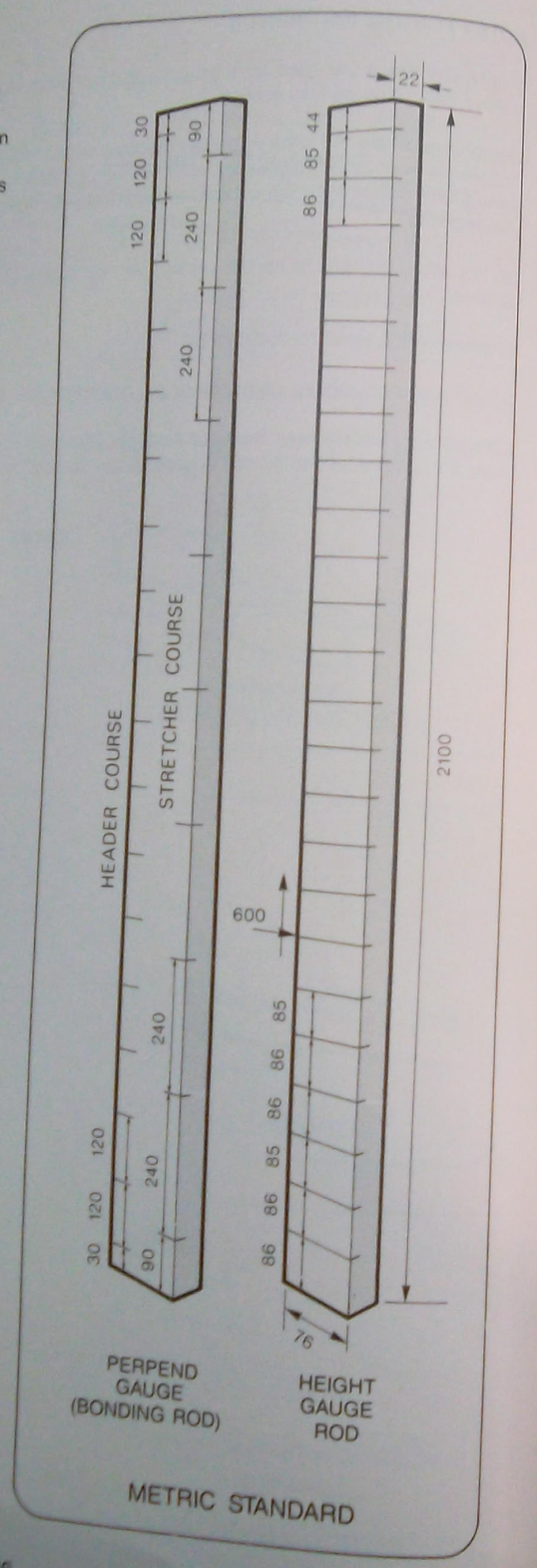
The markings are based on the nominal size of the brick which is the actual size plus a 10 mm joint.

Such gauges can be made for all the available brick sizes (see relevant tables).

Every fifth notch on the header gauge equals the 600 mm standard module.

Similar gauges should be made also for checking the height of courses.

For the standard metric brick, the notches should be spaced at 86 mm centres, the first one occurring at exactly 86 mm from one end of the gauge. Use the reverse side of the gauge. Mark to 600 mm module at the 7th course, but note that you will be 2 mm higher if you stick rigidly to 86 mm all the way. It is standard practice to make the mark at every third course 85 mm from the last one.



METRIC STANDARD

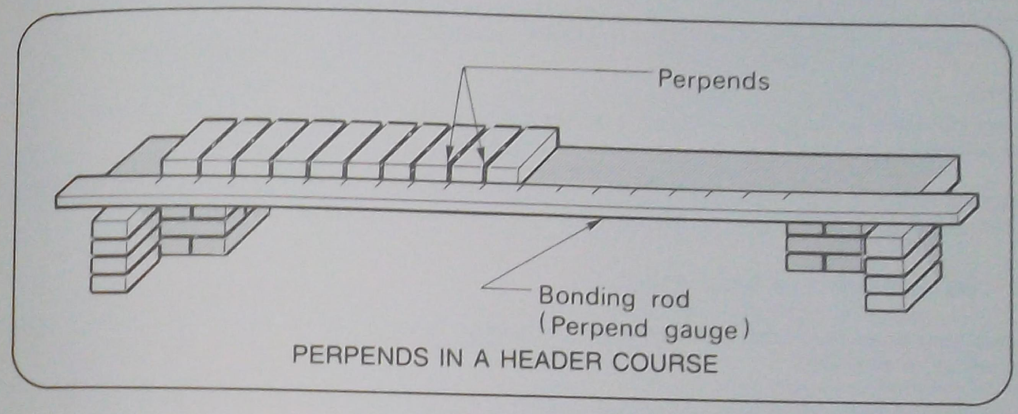
8.1.6 Exercise No 3

To lay a header course from left to right.

For this exercise, the material requirements are the same as for Exercise No 1 with the addition of the bonding rod made at Exercise No 2.

Your work base should be properly arranged before starting.

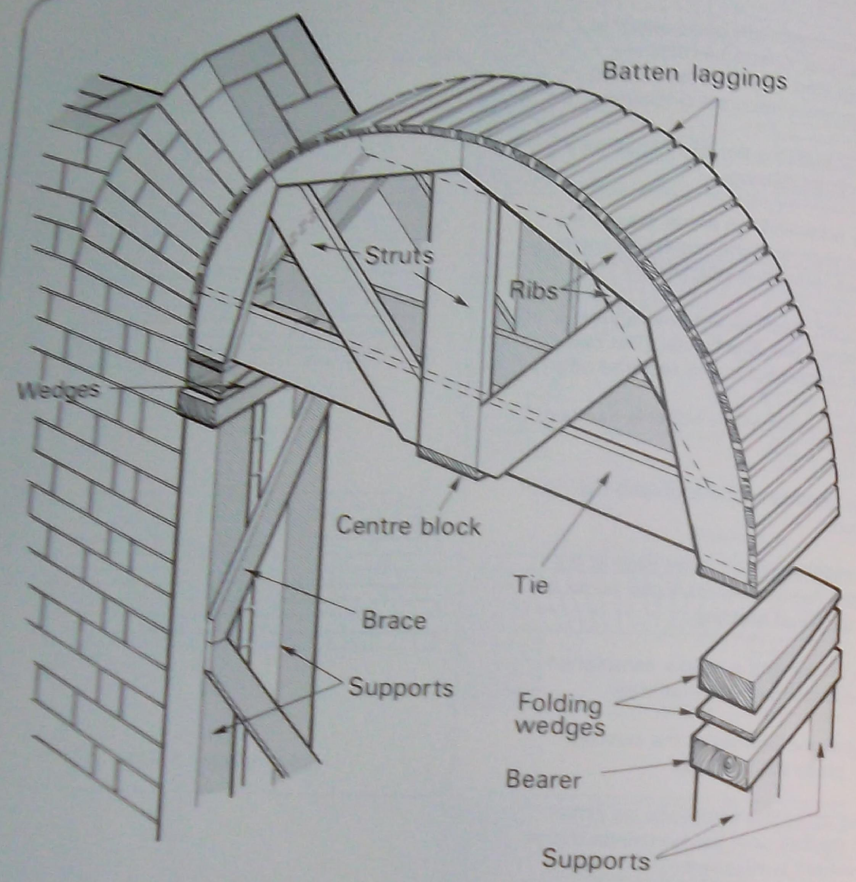
Use the same base set-up as for Exercise No 1. In addition, prepare two additional piers of bricks as shown for the support of the prepared gauge rod (bonding rod).



PERPENDS IN A HEADER COURSE

Proceed as for Exercise No 1.

- Lay and spread enough mortar for 4 bricks.
- Place, bed-in and level the first brick with the header face level with the base edge.
- Remove excess mortar from both header sides.
- Pick up the next brick, select the best header face and butter the left-hand stretcher face.
  - — Alternatively you could have buttered the right-hand stretcher face of the first brick. In that case all right-hand stretcher faces of the bricks should be buttered (except the last one).
- Place it next to the first brick and line it into place, making a 10 mm perpend.
- Remove excess mortar.
- Support the bonding gauge rod on the piers, line up the second mark with the right-hand vertical arris of the first brick and check the alignment of the second brick with the gauge mark.
- Gently tap the brick into alignment with the trowel handle.
- Repeat the procedure until you reach the end of the gauge (17 bricks).
- Grout in any perpends that are not fully filled.



CENTERING FOR A SEMI-CIRCULAR ARCH

REVISION QUESTIONS

1. What is the name given to the bricks that form an arch?
2. What is the purpose of 'skewbacks'?
3. What are the springing points of an arch?

4a. Why is a camber formed in a flat arch soffit?

b. How much rise is it given?

5. Where is the 'springing line' located?

6a. What is the difference between Intrados and Extrados?

b. What are their other names?

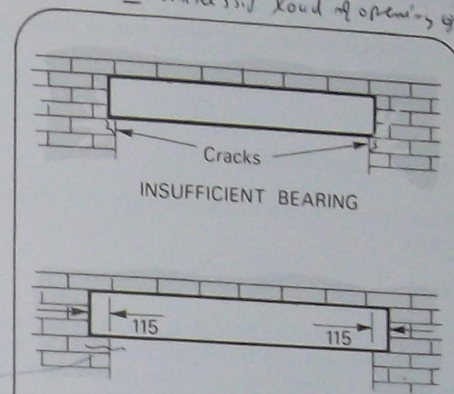
7. How is the load of the brickwork over an arch transferred to the abutments?
8. What is the difference between a rough (ungauged) brick and a gauged brick arch?

14 LINTELS

A lintel is used in construction for the support of brickwork and other loads over an opening. The lintel must be strong enough to carry the load safely and without sagging. As a general rule, when the length of a lintel exceeds 2 metres, it is called a beam.

The bearing surfaces of the lintel ends should be large enough to prevent excessive compressive and shearing forces from crushing or shearing the brickwork supporting them.

The amount of bearing required depends on the load the lintel is to carry and on the strength of the brickwork on which it rests. In any case it should never be less than 115 mm in length for each lintel end and preferably 200 mm.



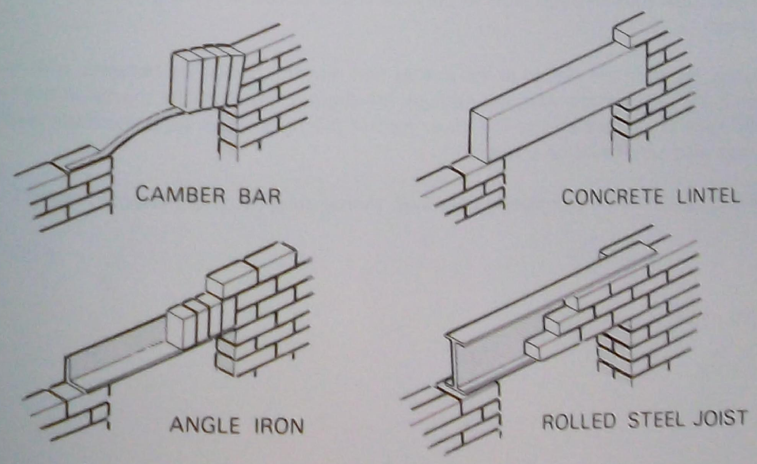
BEARINGS FOR LINTELS

14.1 TEMPLATES

Templates are sometimes used to spread the load at the bearing points of lintels and so relieve the supporting abutments of possible excessive stresses.

These templates may be made of stone, reinforced concrete or steel and their size would be determined according to the load to be supported and the strength of the supporting brickwork in the abutment.

Details of the template would be shown in the constructional drawings and would be mentioned in the specifications for the building.



TYPES OF LINTELS

14.2 TYPES OF LINTELS

Various materials can be used in the construction of lintels. They may be made in:

- steel;
- reinforced concrete, and more rarely in stone;
- reinforced brickwork.

14.2.1 Steel lintels

These include the camber bar, the angle iron, and rolled steel joists (RSJs) of various cross sectional shapes.

14.2.2 Reinforced concrete lintels

These can be obtained pre-cast or they may be boxed and poured in position. Mild steel reinforcing rods are used and held in position by stirrups at their proper distance from each other. The reinforcement should not rest on the bottom of the box before pouring. The lower reinforcing rods should be supported at not less than 20 mm from the bottom of the box to provide sufficient concrete covering of the rods.

The steel used for reinforcing should not be greasy as this would prevent proper adhesion of the concrete.

14.2.3 Stone lintels

Stone is rather brittle and great care should be taken when using stone for lintels. It is advisable to incorporate relieving arches in the brickwork above the stone lintel to prevent the risk of failure.

14.2.4 Reinforced brickwork lintels

Two methods are used to achieve this:

- Placing mild steel rods in bed joints.
- Threading mild steel rods through slots in purpose made bricks or through the perforations of extruded bricks.

In the first method, the rods are placed in the mortar bed and the distances between rods maintained by wire stirrups in the cross joints. Also the stirrups are there to support the mortar in the cross joint. The mortar joint itself in turn adheres to the lower part of the bricks and supports them below the rod level. The stirrups also help to resist shear.

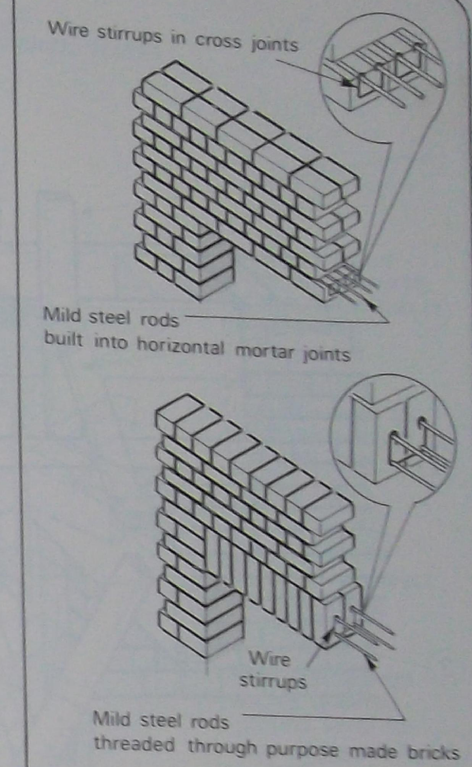
The holes in the bricks must be completely filled with mortar to provide continuous support for the rods.

In both methods it is important to use a strong cement mortar mix of the following composition for the construction of the lintel:

- Maximum: 3 parts of sand.
- Maximum: 1 part of Portland cement.

It is equally important to carry the reinforcement through for a minimum of 115 mm into the jambs on each side of the opening to provide adequate transfer of the load to the abutments.

Centering is to be used during the construction of such lintels but this temporary support should only be removed some time after the brickwork has properly set.



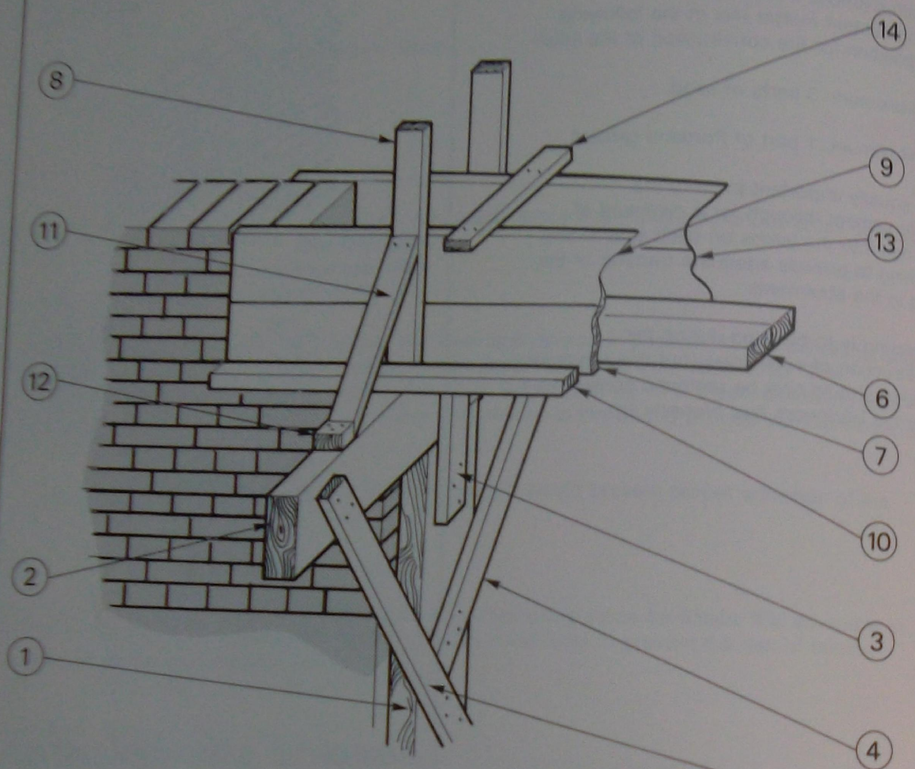
REINFORCED BRICKWORK LINTELS

14.2.5 Assembling a lintel box

The illustration assumes the appropriate timber is available and shows the sequence to be used in building the box.

As an added precaution, it is advisable to provide added supports under the box before pouring starts to prevent sagging in the centre.

It is also most important to ensure that the bottom boards (item 6) clear the jambs or abutments by some 10 mm on each side. This is to accommodate the expansion in those boards which will result from the absorption of moisture from the concrete. Without these clearances, the expansion in the boards would put very great pressure on the brickwork of the jambs and crack it.



BUILDING SEQUENCE FOR LINTEL BOX

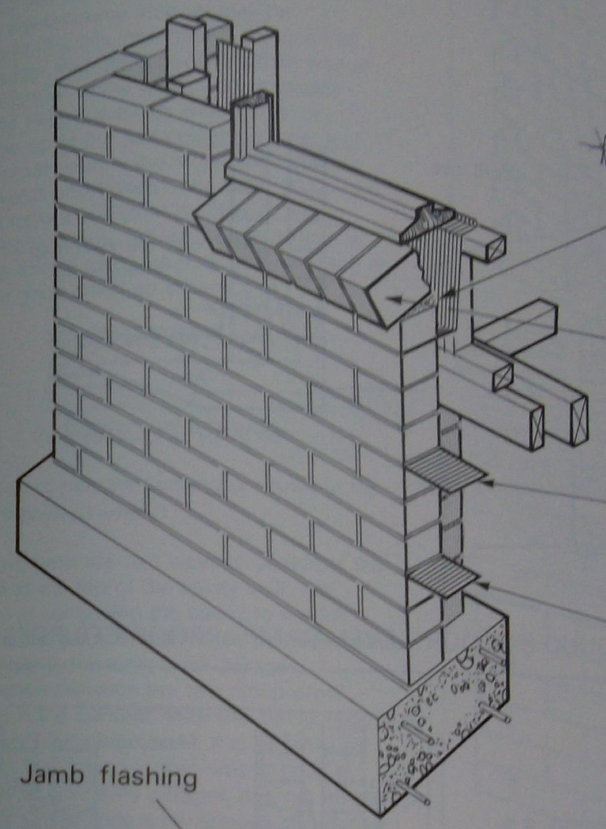
REVISION QUESTIONS

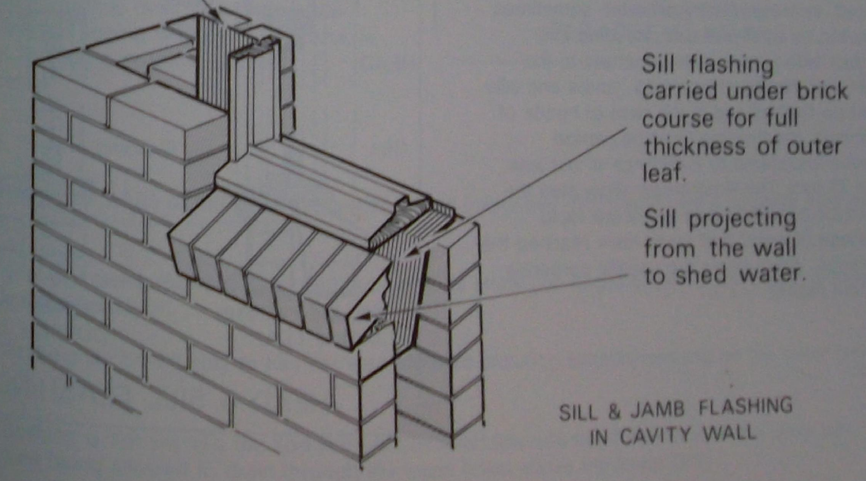
1. What are the likely results on the brickwork of jambs if lintel bearing surfaces were kept small?
2. List the types of lintels that can be constructed and the materials used in each type.
3. What is the role of the stirrups in the building of reinforced brickwork lintels?
4. Why should centering be used in the construction of reinforced brickwork lintels?

15 FLASHING AND JOINERY BUILD-IN

The building must be made damp-proof as we have already seen, but at places where door and window openings are located or where brickwork joints up with other materials and at roof junctions, penetration by water must be either prevented or where penetration could occur, such water must be made to escape readily to where it can do no harm. The illustrations show various locations and applications of flashing.

SILL & JAMB FLASHING IN BRICK VENEER



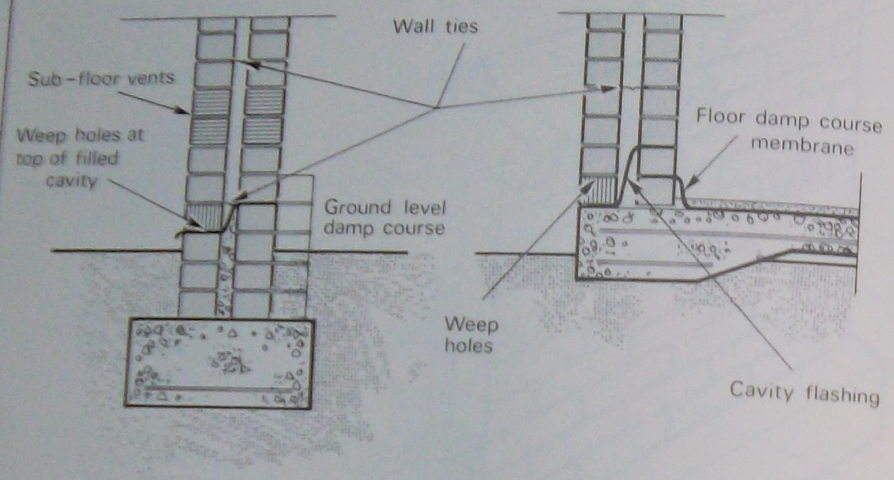


SILL & JAMB FLASHING IN CAVITY WALL

SILL & JAMB FLASHING

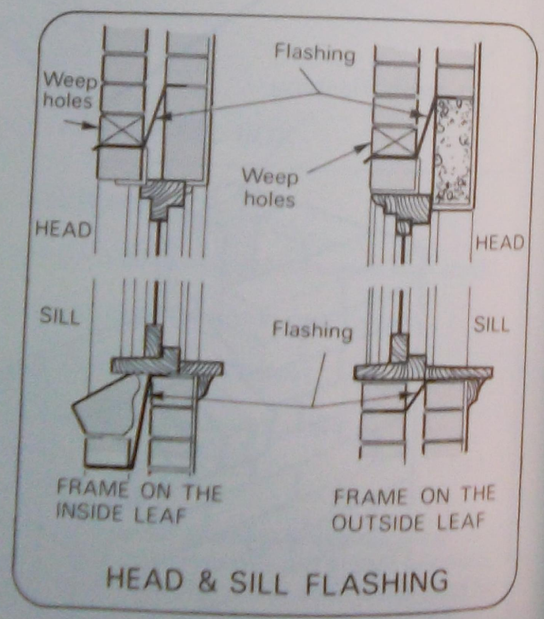
15.1 CAVITY FLASHING

The cavity acts as a barrier between the sometimes damp outer leaf and the inner leaf which must be kept dry at all times.



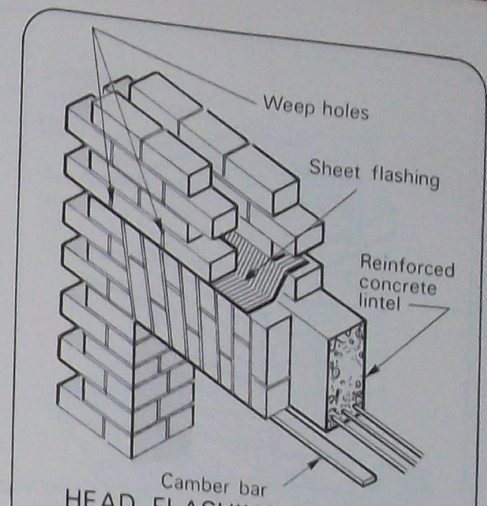
FLASHING AT GROUND & FLOOR LEVEL DAMP-PROOF COURSES

At window openings and door openings, it is necessary to provide flashings, carefully placed, to prevent entry of water, sometimes assisted by wind pressure, to come into contact with joinery or to penetrate to the inner leaf. Heads of openings, jambs and sills must be flashed and in the case of heads of openings, the flashing must be carried beyond each jamb to a distance of not less than 75 mm. The illustrations show also the provision of weep holes to ensure rapid drainage of water that could have reached the flashings. Weep holes are usually perpends without mortar.



HEAD & SILL FLASHING

Because wind pressure could hold water at weep holes or even force it inwards towards the inner leaf or the framework, the flashing must be stepped upwards to prevent this from occurring. It is usual to step up the flashing one course, but in areas of very high winds a two-course step up may be advisable. Equally important is the need to drain water that could have found its way at the bottom of cavity walls. This is usually done by filling the cavity with mortar or concrete up to but just below the inner leaf damp-proof course and sloping the surface downwards and towards the outer leaf which should have a sufficient number of weep holes for drainage. Where the cavity wall is built-up from a concrete floor slab, flashing is used to good effect as shown.

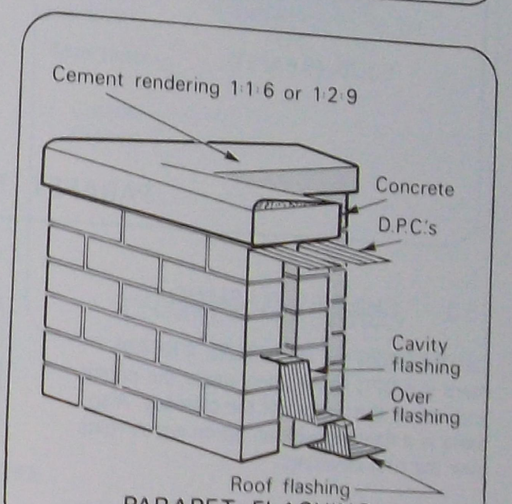


HEAD FLASHING OF CAVITY WALL OPENING

15.2 PARAPET FLASHING

Execution of parapet flashing is shown in the illustration.

Note that there are two ways to construct the parapet at the top of the cavity wall. The practice of continuing the cavity to the full height of the parapet eliminates the weakness that results in the solid brick parapet continuation between the two damp-proof courses in the parapet. With the introduction of the modular metric brick, it is possible to carry out the coping in that size of brick in the case of the cavity parapet. It is not strictly necessary to provide a continuous damp-proof course under the parapet coping if it is built in brick, but it is desirable to do so, especially if the coping is done in concrete. In this case, the damp-proofing prevents efflorescence.



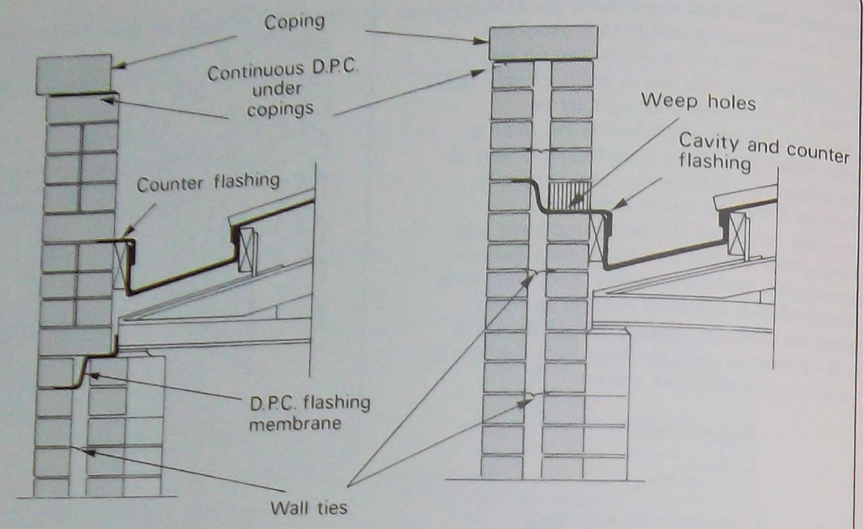
PARAPET FLASHING

NOTE:

Flashing to the full width of the outer leaf under the sill bricks bed joint would give a negative joint (no bonding).

For practical purposes, flashing is carried out either as shown on pages 63 to 66 and under window sills (with weep holes) or;

- The flashing is carried only to half the wall width so ensuring suitable bonding on the outer face, or,
- The flashing is not set into the bed joint, but directed towards the inside face of the outer leaf; moisture being allowed to drain through the weep holes above the lower DPC.



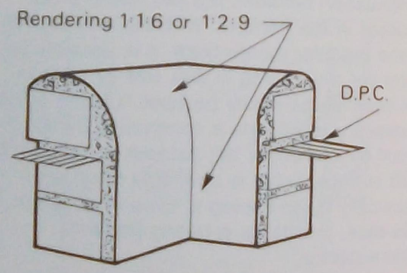
PARAPET FLASHING

15.3 CHIMNEY FLASHING

Carefully study the illustrations. It reveals there is a DPC immediately under the coping and one at the bottom of the chimney. Also, there is a flashing with an apron which rests over the roof covering.

Base flashing, with upturned ends against the chimney brickwork rests on the roof covering on either side.

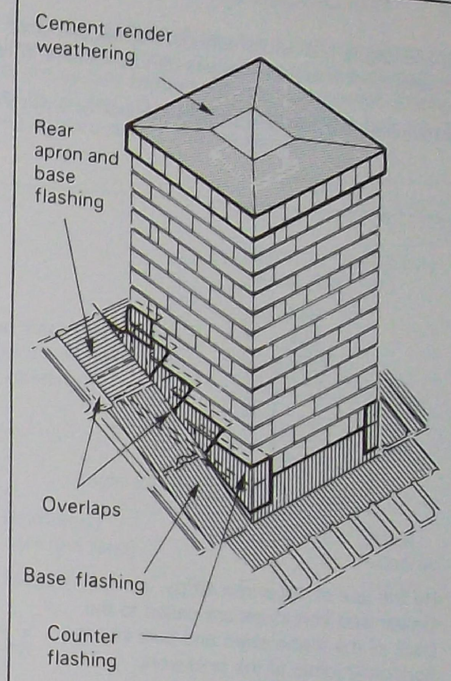
Counter flashing set into bed joints and overlapping in downstream fashion overlaps the base flashing so that any water from the bickwork on the sides of the chimney is shed onto the base flashing.



USUAL COPING D.P.C.

The rear of the chimney also has flashing set into a bed joint and the apron formed there sheds the water from the chimney wall as well as any running from the roof covering onto the base flashing.

The material very often used for the flashing of chimneys is galvanised iron. The durability of this material at this location is doubtful but it can be improved by coating it with red lead or zinc chromate. It is best to use lead sheeting.



CHIMNEY FLASHINGS

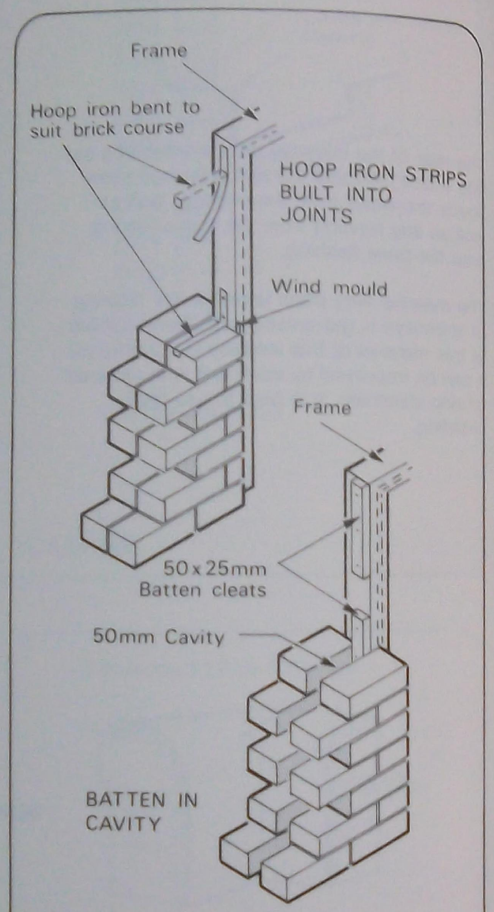
NOTES

15.4 BUILDING-IN OF JOINERY

How flashing is built-in for window frames and door frames has been illustrated under para 15.1 and also how the frames themselves can be located in relation to the brickwork in cavity walls.

The following illustrations show a number of ways in which frames can be fixed to brickwork:

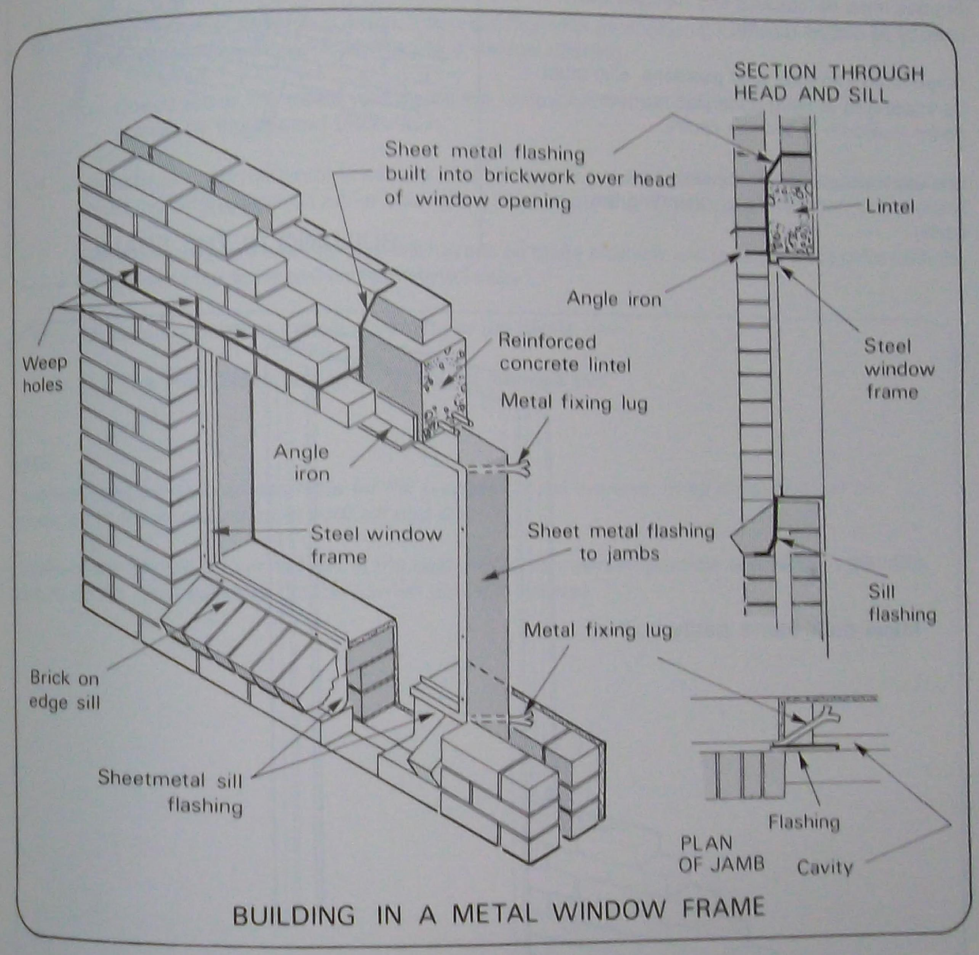
- By the use of hoop iron strips. Galvanised iron strips are nailed to the back of the frame stiles and built into the horizontal joints of the brickwork
- By using 50 x 25 mm batten cleats nailed to the back of the stiles
- By plugs driven into the mortar joints after the mortar has been raked out and nailing the stiles to those plugs.



BUILDING-IN JOINERY

15.5 BUILDING-IN METAL FRAMED WINDOWS

These are held in position by metal lugs of various shapes to suit the particular position in which they are used. The lugs are bolted or welded to the window frame and the protrusions of the lugs built into the mortar joints and the lintel. Metal window frames are usually flashed with the appropriate material (galvanised iron or sheet lead, etc) bolted or screwed to sill and stiles of the frame before being built-in. Flashing to the head of the opening is done during construction of the brickwork.



BUILDING IN A METAL WINDOW FRAME

15.6 BUILDING IN METAL DOOR JAMBS

Steel door jambs are a recent innovation to the building trade. These frames are of a rigid construction and incorporate the architrave in design, thus bricks may be fitted completely into the jamb, giving a firm adequate fixing when building into brickwork.

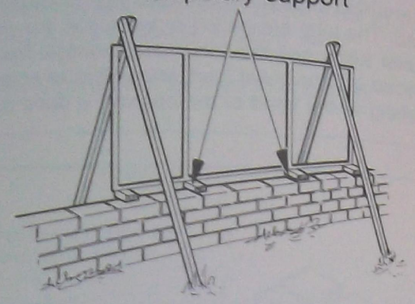
15.7 BUILDING-IN ALUMINIUM DOORS AND WINDOWS

Aluminium windows and doors are delivered to the building site in a factory pre-finish condition and require care to avoid damage during construction.

Frames must be stacked and handled with care by all trades on site.

When lifted into their final positions, sills must be supported at least under the corners — under mullion's and in the centre.

Bricklayers must check regularly that brickwork is not twisting or distorting the frame.



RIGHT

BUILDING IN THE FRAMES

METAL DOOR FRAME

16 MORE PRACTICAL EXERCISES

16.1 COMBINED EXERCISE — WALLS AND OPENINGS

This exercise consists of 4 separate parts as detailed in the illustration:

- **A** — The construction of a wall 3.6 metres long, one unit thick, in stretcher bond with a central door opening 1.2 metres wide and 22 courses high executed in standard metric brick.
- **B** — Construction of an infilling panel, 7 courses high with an additional inner top course as shown. This will convert the door opening to a window opening.

  — Constructing this panel will require the removal of the headers in courses 1, 3, 5 and 7 as shown by the shaded bricks in A.
- **C** — Construct an ornamental brickwork lintel in soldier course backed by stretcher courses and finishing off the wall on either side of the lintel, level with its top edge.

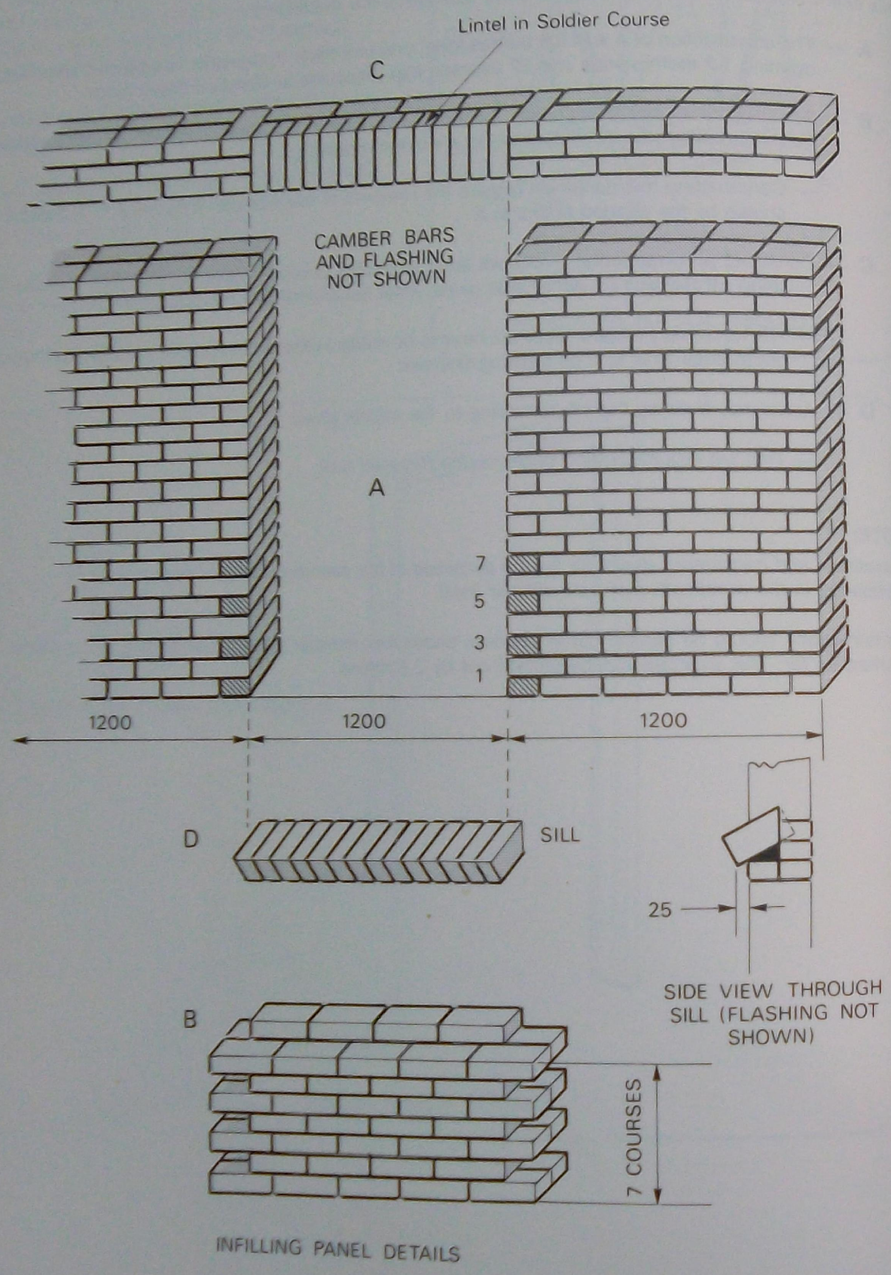
  — The necessary camber bars will have to be made available and properly located for both the ornamental lintel and its backing courses.
- **D** — Accurately building the sill according to the details given.

  — This will require cutting bricks to the required size.

NOTE:

If available and considered desirable for the purposes of the exercise, fixing of flashing can be introduced in the construction of both sill and lintel.

Constructions should be carried out in the best tradesman manner possible according to the skills learned so far. This exercise can be carried out by 2 trainees.



COMBINED EXERCISE

16.2 Constructing wall junctions

The following exercises, which can be used in any sequence, are designed to enable trainees to put bonding and tie-in rules into practice.

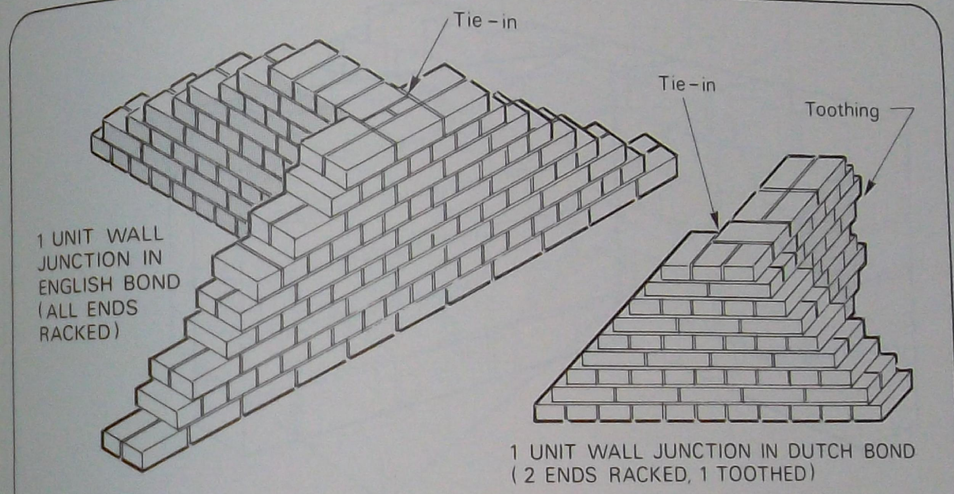
The two walls must remain at right angles and the junction perpendicular. Accuracy of levels, plumbness of wall faces and stopped ends, regularity of joints and vertical alignment of perpends must be strictly observed throughout these exercises as well as neatly finished joints and clean brick work.

16.2.1 Exercise No 1

Construct a wall junction in English bond, 9 courses high in standard metric brick and 1 unit thick.

16.2.2 Exercise No 2

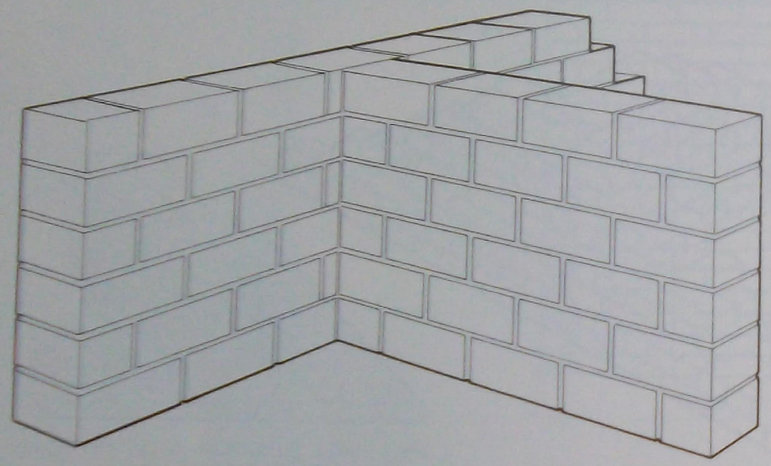
As for exercise No 1 but in Dutch bond with 2 racked ends and one toothed end as shown.



EXERCISES 1 AND 2

16.2.3 Exercise No 3

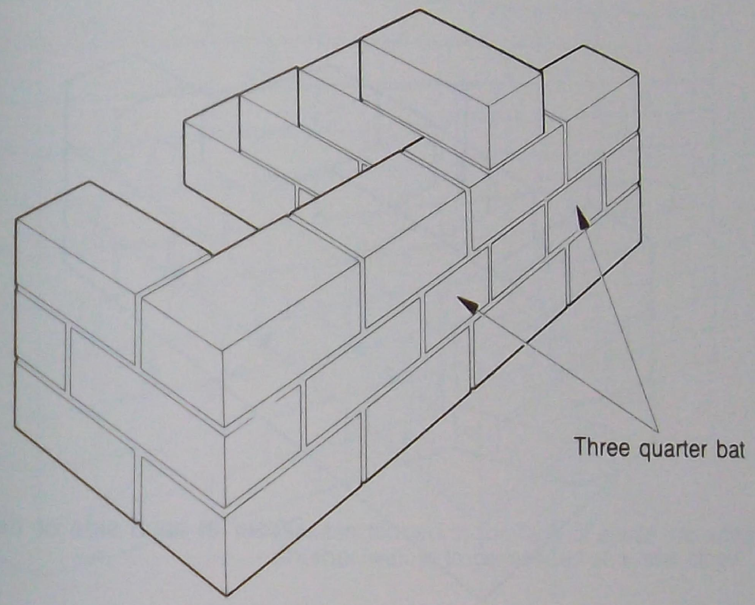
Construct a wall junction in stretcher bond 7 courses high in standard metric bricks 110 mm thick. The junction wall must be tied in each alternate course.



WALL JUNCTION EXERCISE

16.2.4 Exercise No 4

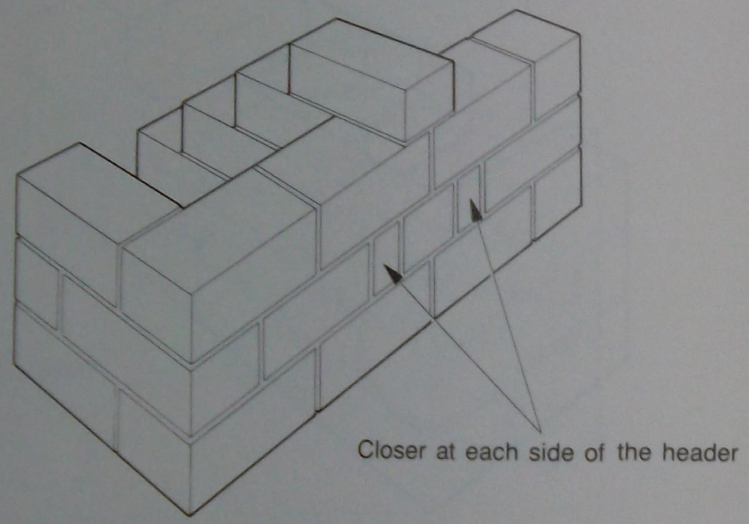
Construct a wall junction in stretcher bond 7 courses high in standard metric bricks 110 mm thick. The junction wall must be tied in each alternate course using a three quarter bat at each side of the header tie.



BONDING JUNCTION WALLS (EXERCISE)

16.2.5 Exercise No 5

Construct a wall junction in stretcher bond 7 courses high in standard metric bricks 110 mm thick. The junction wall must be tied in each alternate course using a closer at each side of the header tie.

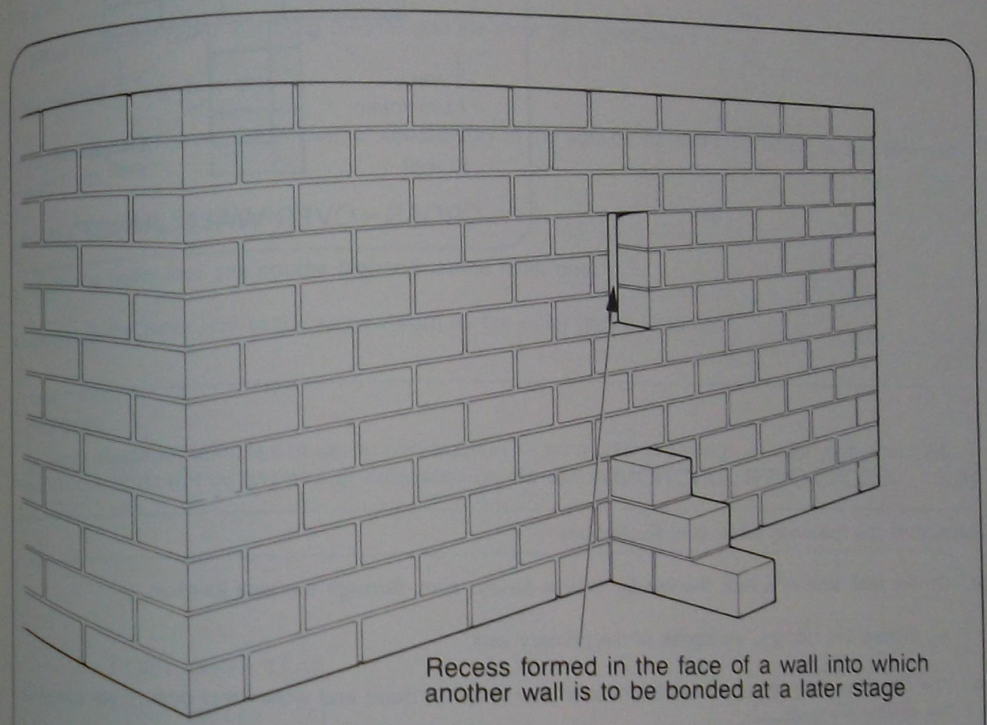


BONDING JUNCTION WALLS (EXERCISE)

16.2.6 Exercise No 6

The exercise consists of building a 110 mm wall in standard metric bricks indented with two stopped ends and consisting of thirteen courses.

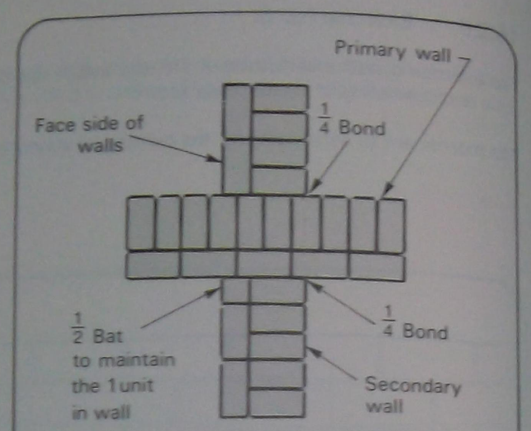
The indents are to serve later for the building of a junction wall in stretcher bond 110 mm thick.



INDENT

16.2.7 Exercise No 7

Finish the three walls shown in the illustration with stopped ends and 13 courses high.



CROSS – OVER WALL JUNCTION

16.3 CROSS-OVER JUNCTIONS

Remember the following rules: (see illustration)

- On the face side of a wall, the header course always runs through the wall junction.
  - — Where this occurs, we speak of the primary wall.
- The stretcher course butts onto the header course at 1/4 bond and where this occurs we speak of the secondary wall.
- Primary and secondary walls change location at each alternate course.
- On cross-over wall junctions drawings, the internal corner of the face side must be indicated.

16.3.1 Exercise No 8

Using the existing wall junction of exercise No 6, finish the cross-over with 7 stretchers in the first course and to a height level with the existing wall junction. Wall ends to be stopped.

16.4 CAVITY WALLS

16.4.1 Constructing a cavity wall corner

Having obtained the proper levels and set out the wall lengths, build the corner of the cavity wall to the dimensions shown and closing the wall ends with a suitable bond pattern. Cavity space ? 60 mm. External joints concave pointed. In this exercise, the necessary wall ties will have to be built-in according to the tables given at para 9.

The wall can be built-in either of these 2 ways:

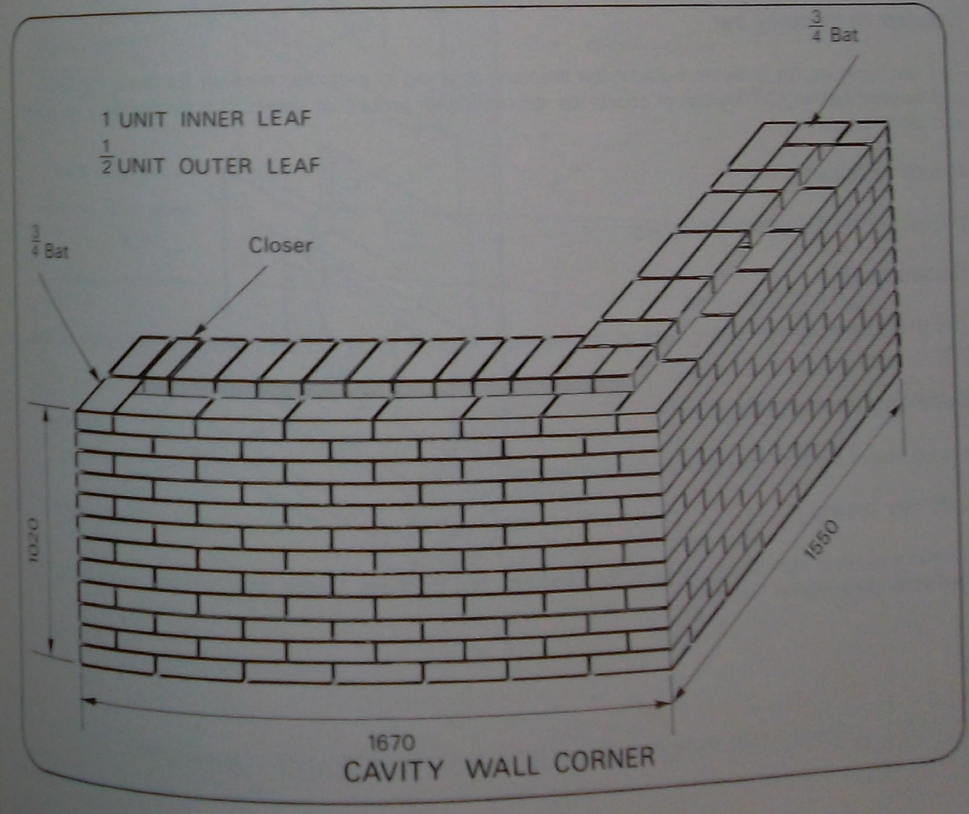
- Either build the outer leaf from outside and the inner leaf 'overhand';
- Or the other way round.

Whatever way is chosen, the bricklayer should stay at the side of the wall from which he has selected to build it up.

Adopt the following procedure:

- Build the outer leaf one course higher than the inner one.
- Bring up the inner leaf to the same height as the outer leaf, and so on.

CAUTION:
Observe absolute neatness of cavity construction — no mortar droppings, or joints not smoothed out. There must not be any mortar droppings on the wall ties.



CAVITY WALL CORNER

NOTE:
The exercise may be repeated over longer wall distances and to a greater height using 1/2 unit thicknes for both inner and outer leaves and varying cavity spacings as desired.

17 CHIMNEYS AND FIRE PLACES

17.1 TERMINOLOGY (see illustration)

Chimney footing

The main body of the chimney is carried on concrete or brick offsets bedded on the foundation.

Fender wall footing

This is the footing which carries the fender wall.

Fender wall

The wall construction supporting the front edge of a hearth to a ground floor fireplace.

Fireplace jambs

The brick work on either side of the fireplace opening which carries the breast brick work. Flues from lower floors may be formed in the jambs of the upper floors.

Hearth

The masonry construction which projects from the face of the jambs at floor level is called the hearth. It is usually constructed in concrete and may be finished with brick or tile facings and its purpose is to protect the timbers of the flooring from catching fire.

Camber or chimney bar

This bar supports the brick work above the fireplace opening in a similar manner as done for door and window openings. They can of course be spanned with arches or lintels in a similar way as door and window openings.

Mouth or throat

The inlet to the flue from the fireplace.

Smoke shelf

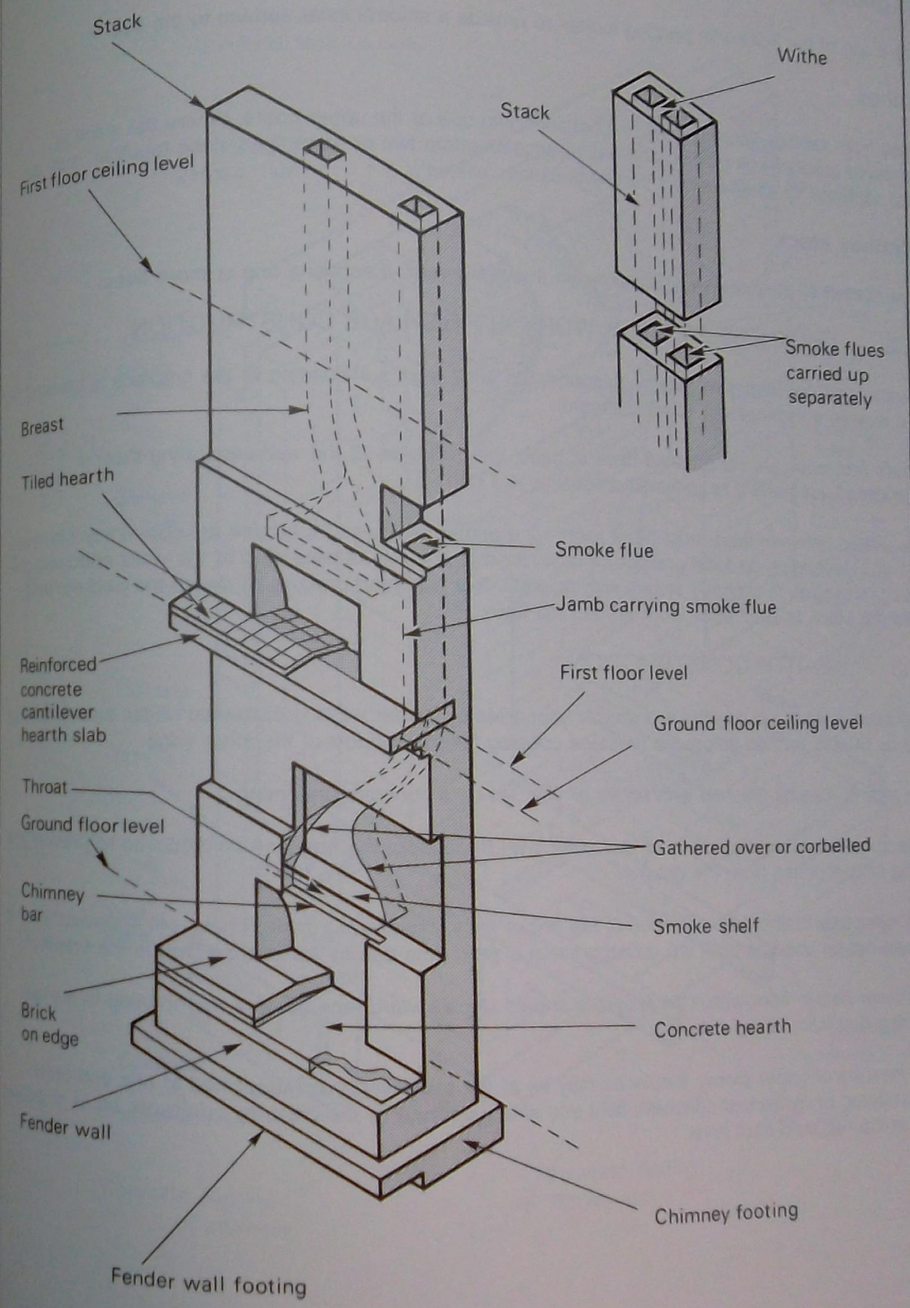
The shelf formed by the sloping back of the fireplace where it joins the brick work at the brick of the flue.

Gathering (or corbelling)

Any section of the flue changing shape or direction.

Chimney breast

The mass of brick work which contains the openings and the flues. Upper floor breasts may carry the flues from lower floors.



CHIMNEY CONSTRUCTION FOR TWO STOREY BUILDING

NOTE:
The exercise may be repeated over longer wall distances and to a greater height using 1/2 unit thicknes for both inner and outer leaves and varying cavity spacings as desired.

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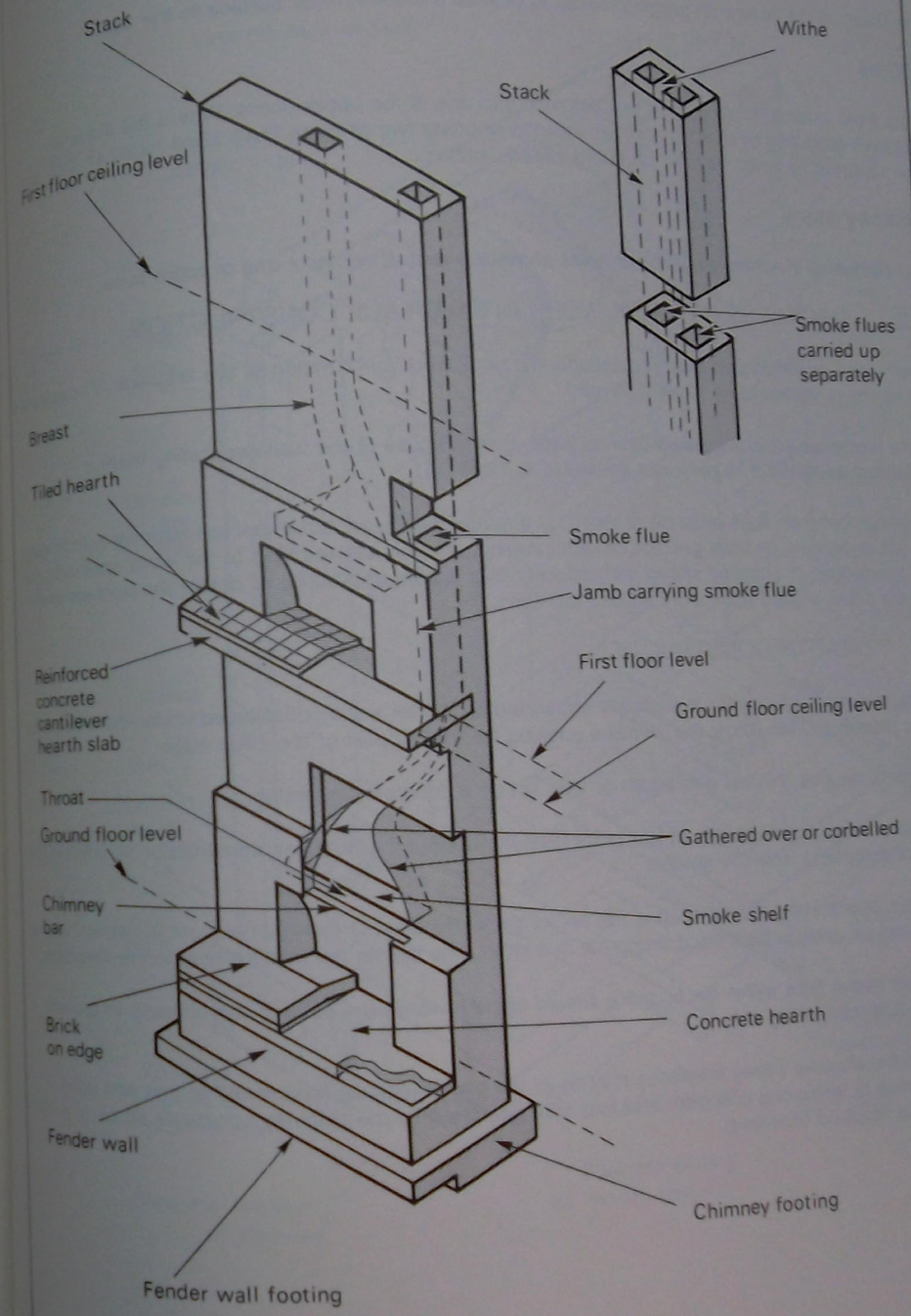


CHIMNEY CONSTRUCTION FOR TWO STOREY BUILDING

Smoke flue

The tubing formed in the brickwork to carry the smoke and the fumes from the fire place to the outer air.

Pargetting

The lining of the flues with parging mortar to provide a smooth inner surface to the flue.

Withes

Flues from various floors cannot be combined into one at the upper floors. Where the stack is narrowed gradually by racking and has to accommodate two or more flues close together, they are kept separate by small walls or partitions called: 'withes'.

Chimney stack

That portion of the chimney which projects above the roof. It contains one or more flues.

17.2 THICKNESS OF BRICK WORK IN FIREPLACE CONSTRUCTION

Usually, and depending on local regulations, the brick work surrounding of the fireplace is constructed to a minimum thickness of 1 unit (230 mm).

Where fireplaces are constructed back to back, the thickness of the wall separating them is considered adequate if its minimum thickness is 1 unit.

The withes between flues must be at least 1/2 a unit in thickness, but these are commonly increased to 1 unit depending on local practice or requirements and this applies also to the walls enclosing the flues themselves in chimney stacks with pockets. It is accepted practice to delete the pockets and build the stack in solid brick work around the flues.

17.3 HEARTH CONSTRUCTION

At ground floor level, hearths are usually supported by fender walls constructed under the outer edge and by offsets formed below the fireplace opening for the support of the inner edge.

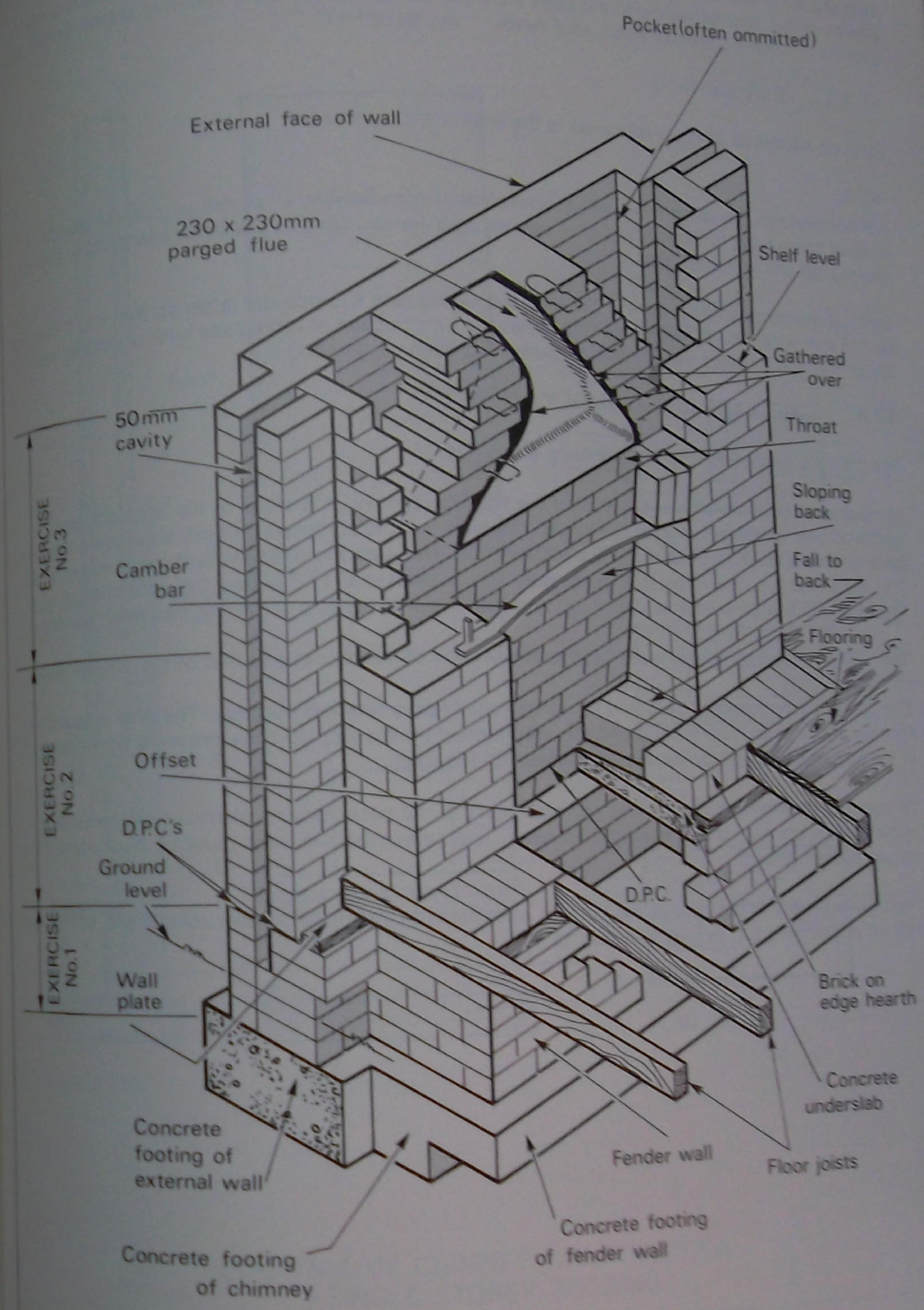
The hearth may be finished with bricks or tiles set on a concrete underslab.

A damp-proof course is built in at wall plate level throughout the fireplace construction to prevent the rising of dampness from the ground.

The inner hearth should be finished in fire bricks set in fire clay. Ordinary bricks set in cement mortar should not be used as both will disintegrate in a short time due to the intense heat in the fireplace.

The inner hearth floor within the fireplace should slope towards the back of the opening to prevent burning fuel from falling out.

The hearths of upper storey fireplaces may be of the cantilever type (supported at one end only) constructed of reinforced concrete, built into and supported by the chimney brickwork so as to project out at the required floor level.



EXAMPLE CONSTRUCTION OF A GROUND FLOOR FIREPLACE

17.3.1 Exercise No 1

With the aid of the illustration, construct the fender wall, the offset to the damp-proof course and the portion of the external walling to the sizes shown in the illustration, using standard metric bricks (to 5 courses in height). Carefully watch your levels.

17.3.2 Exercise No 2

Build up the details of the fireplace up to the level of the camber bar.

NOTE:
For this exercise, if a suitable pre-cast concrete slab is not available, a number of suitable planks or suitable timbers, cut to the required size, may be used instead. On this, the inner hearth floor and the hearth itself can be constructed.

Build up the jambs and the back of the fireplace, taking care to slope the latter so that the throat will be 115 mm wide. The illustration at 17.3 shows the construction of a fireplace with a sloping back to obtain this and it shows the way this corbelling has been carried out.

17.4 FIREPLACE AND CHIMNEY BREAST

The chimney breast contains the gathering of the flue.

Immediately above the arch or the lintel of the fireplace opening, the sides of the fireplace are gathered over (corbelled) to form the throat. The brick work is corbelled on both sides then stepped back on one side so as to form a 230 x 230 mm flue. This sets the direction and the position of the first run of the flue. The throat is 115mm wide. The illustration at 17.3 shows the construction of a fireplace with a sloping back to obtain this and it shows the way this corbelling has been carried out.

The next illustration shows in cross-section the location of that throat and that of the smoke shelf.

The combination of sloping back and the smoke shelf has a two-fold purpose. The first is to prevent the heat rising straight up the flue and the shelf formed by this sloping back prevents down draughts in the flue which could blow smoke and fumes into the room.

By carefully reinforcing the corbelling with wall ties, it is not necessary to construct the remaining section of the chimney breast in solid brick work. This saves material but it must be carefully done to ensure proper strength.

The chimney stack is provided at the top with a weathered capping of cement render and sometimes with an additional d.p.c. as well (see also 15.3).

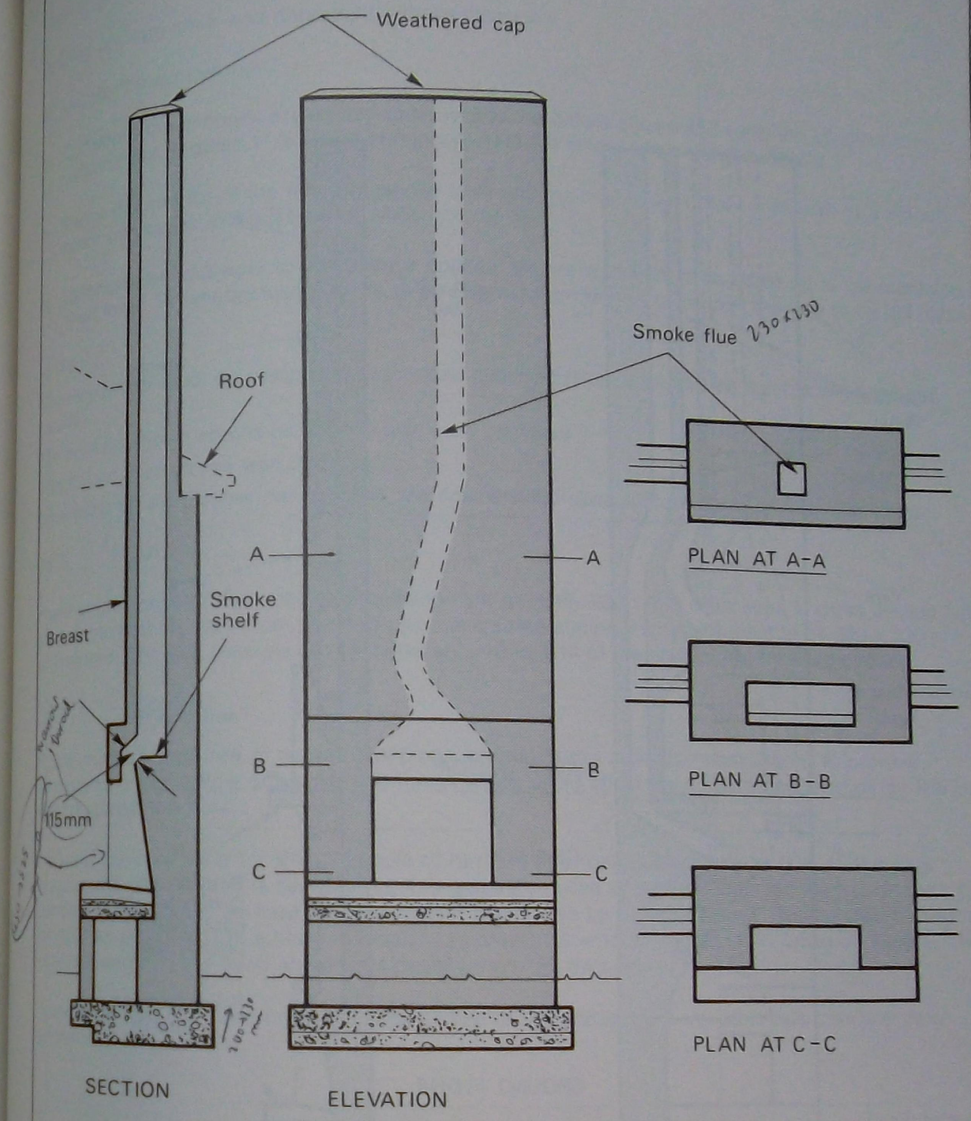
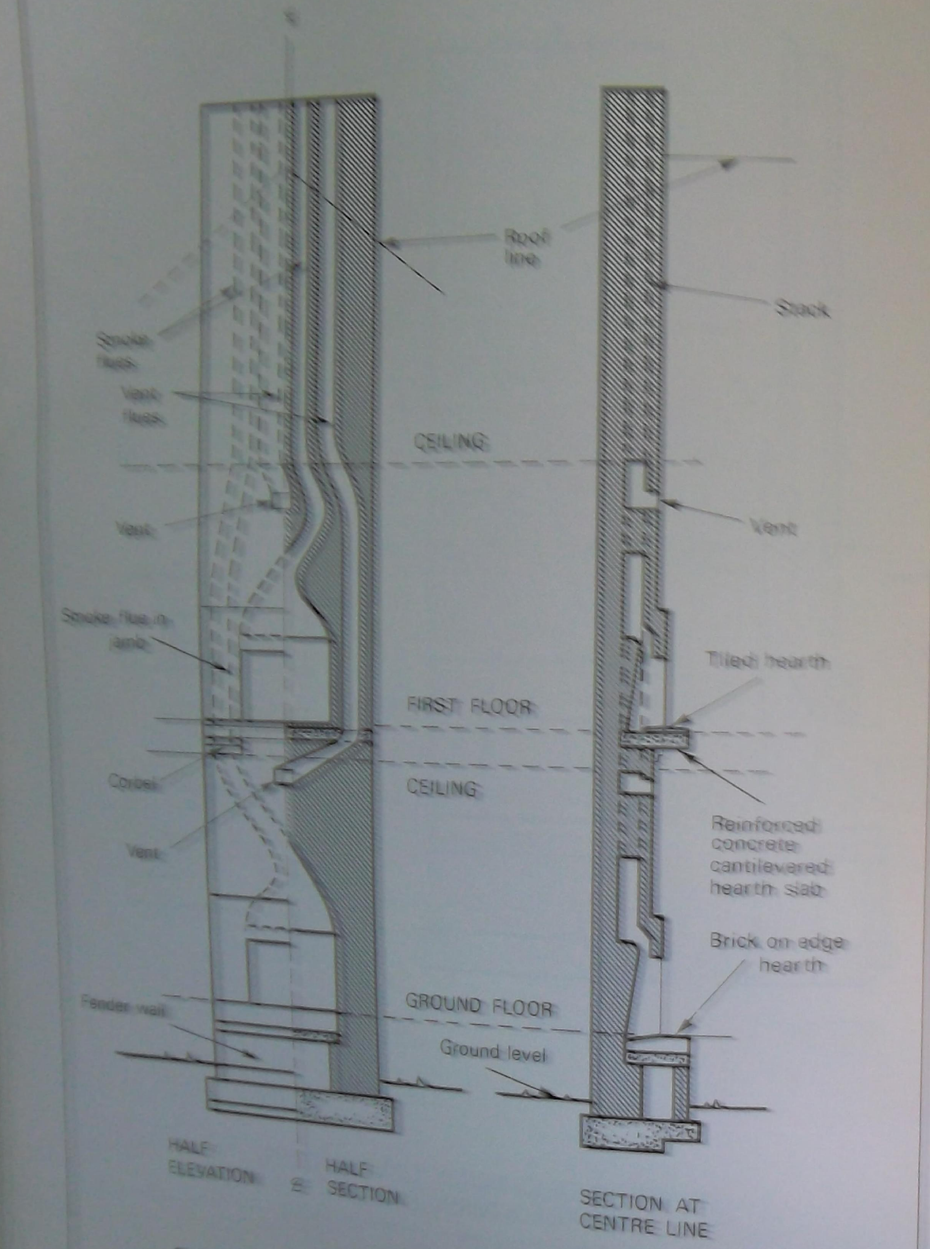


DIAGRAM OF CHIMNEY CONSTRUCTION
- SINGLE STOREY BUILDING



CHIMNEY CONSTRUCTION WITH ROOM VENTILATION FOR A TWO STOREY BUILDING

17.4.1 Exercise No 3

Refer to the illustration at page used for exercises Nos 1 and 2.

Building up from what was done during those exercises:

- Locate the camber bar.
- Construct the chimney breast and outer wall to the details shown and carry the construction upwards for another 11 courses and incorporate the smoke shelf and flue details.
- Parge the interior of the flue, the smoke shelf and the rear of the breast brickwork to a smooth finish as you go along (see also 17.5).
- Exterior wall brickwork to be concave pointed; interior wall work to be raked up to the mantelpiece shelf level. Breast brickwork joints to be finished flush and all brickwork showing to be left clean.

NOTE:

Chimney breast must be completed to the level specified (illustration has left it out to show internal details).

The pockets shown should be filled in with solid brickwork.

There is no need to use wall ties.

Depending on the camber bar supplied, the lintel may be done stretcher bond or in solider course.

17.5 FLUES

Flues in chimneys of domestic type buildings are normally 230 x 230 millimetres in cross section but local requirements vary from place to place and some authorities require them to be 360 x 230 millimetres. The flue area should be between 1/10 to 1/14 of the area of the fireplace opening.

17.5.1 Coring

Flues must be kept free of mortar droppings, broken bricks and other obstructions to prevent interruptions in the flow of smoke and fumes which could affect the efficient operation of the flue by slowing down the flow.

To keep the core clear for this, a bundle of hay tied to a rope is placed in the flue. As the work progresses and parging is being done, it is gradually pulled up and any debris collecting on the bundle, which should be kept at a convenient height, can be easily removed. Flues should be kept as straight as possible, but a bend is required to prevent downdraughts and rain falling on the fire. The included angle in the bend should not be less than 130 degrees.

Remember that the flue from a fireplace should be separated from any other flue from any other fireplace.

17.5.2 Flue linings

Flues are lined with 'parging', a mixture of lime and cement mortar. This mixture is trowelled on to a thickness of some 12-13 millimetres finished smooth and rounded at the corners.

17.5.3 Damp-proofing of chimneys

(see details on damp-proofing and on flashing, paras 8 and 15).

17.5.4 Stacks

Stacks may incorporate room ventilation flues. There is an advantage in doing this because the heat from the smoke flues heating the air in the ventilation flues, makes the air in those rise and in doing so, creates a natural exhaust system for the removal of foul and moist air from rooms.

The height of a stack is determined by its position relative to the roof, the height of adjacent buildings or other obstructions to the flow of air, such as high trees for example. Stacks should be carried up high enough to avoid downdraughts in flues.

The height should not usually exceed six times the dimension of the least breadth of the chimney construction and the whole of the stack built with cement mortar for strength. In any case, the last six courses should be in cement mortar and the tops weathered.

17.5.5 Smokey chimneys

Smokey chimneys are usually the result of the following defects:

- Too many bends in the flue.
- Bends too abrupt.
- Stack too short in relation to surrounding obstructions to airflow.
- Leak in the flue due to defective parging or brickwork.
- Obstruction in the flue (coring faulty).
- A pocket at each side of the fire place (not gathered steeply enough to the throat).

REVISION QUESTIONS

1 What is the purpose of the fender wall?

2 What portion of a chimney is the stack?

3 What is the minimum thickness of the brickwork around the fireplace and for withes?

4 Why is the inner hearth sloped towards the back?

5a What is the usual size of the flue?

b Is this a set dimension and if not, how can it be determined?

6 What is the purpose of the smoke shelf and how is it made?

7 What should the minimum size of the throat be?

8a Why should flues be parged?

b What does parging consist of?

9 What precautions should be taken to avoid down draughts in the construction of a chimney?

10 Why should corbelled flues be reinforced and how should this be done?

NOTES

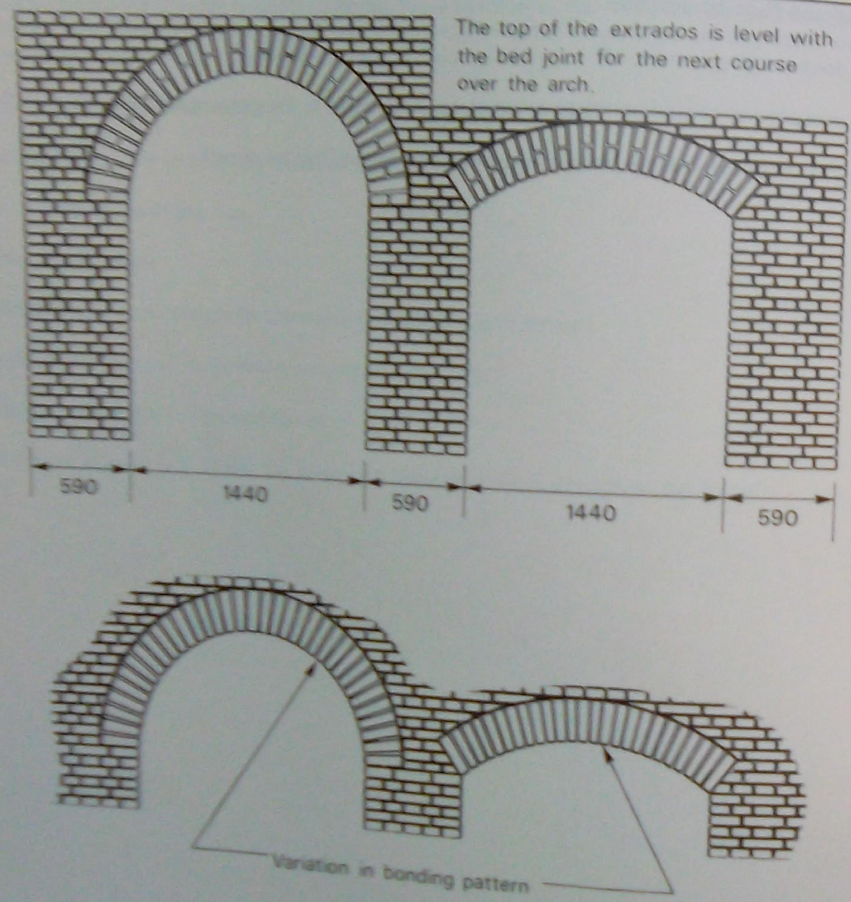
18 EXERCISES IN BUILDING ARCHES

18.1 GENERAL

Where conditions allow, training areas should be set up where the abutments required for the building of arches feature as a permanent fixture up to the springing line. This saves valuable time which can be devoted solely for arch construction and other activities in a bricklaying course. Three abutments in line would suffice.

If this is not possible, then as an additional exercise, preferably by a group, the abutments can be constructed as part of the whole exercise.

The necessary centering for the types of arches to be built on these abutments must be available and it is valuable practice for trainees to be made to locate them accurately and securely before constructing the arches.



ARCH BUILDING EXERCISE – SUGGESTED SIZES

18.2 CALCULATING THE AMOUNT OF BRICKS

In general, the bricklayer will be told whether and which arches are to be rough or gauged.

For rough (ungauged) arches he will be given the following information:

- The length of the intrados.
- The rise from the springline.
- The thickness of the wall.
- The number of rings in the height of the arch.

For gauged arches the bricklayer will be told:

- The length of the intrados.
- The height on the face of the arch.
- The width of the exposed portion of the soffit.
- The rise.
- The shape and type (e.g. semi-circular, segmental, relieving or otherwise).
- Whether purpose made bricks will be supplied.

To determine how many bricks are needed and to what size he has to cut them, the bricklayer can do any of the following?

- Do an actual full size lay out on the ground, or
- Draw up the details to scale, or
- Calculate the number and dimensions of the bricks for the arch (suitable only for semi-circular arches).

Remember also that, except for flat arches which are often supported on camber bars and for relieving arches as auxiliaries to lintels, as well as pointed arches (eg Gothic, which take a birdsmouth key), all other types have an odd number of bricks and a key placed centrally in the crown, that is, midway on the span. Therefore in any layout or calculation it is only necessary to find out the details in half the arch to arrive at the final answer by multiplying by two and adding one for the key.

18.2.1 Semi-circular and segmental rough (ungauged) arch.

Possibly the quickest way to work out the number of bricks needed for this type is to calculate it rather than laboriously laying it out or scaling it.

Calculation example:

Suppose the length of the intrados is given as 2266 mm.

Remember we have only to consider half the arc less half a brick (the key).

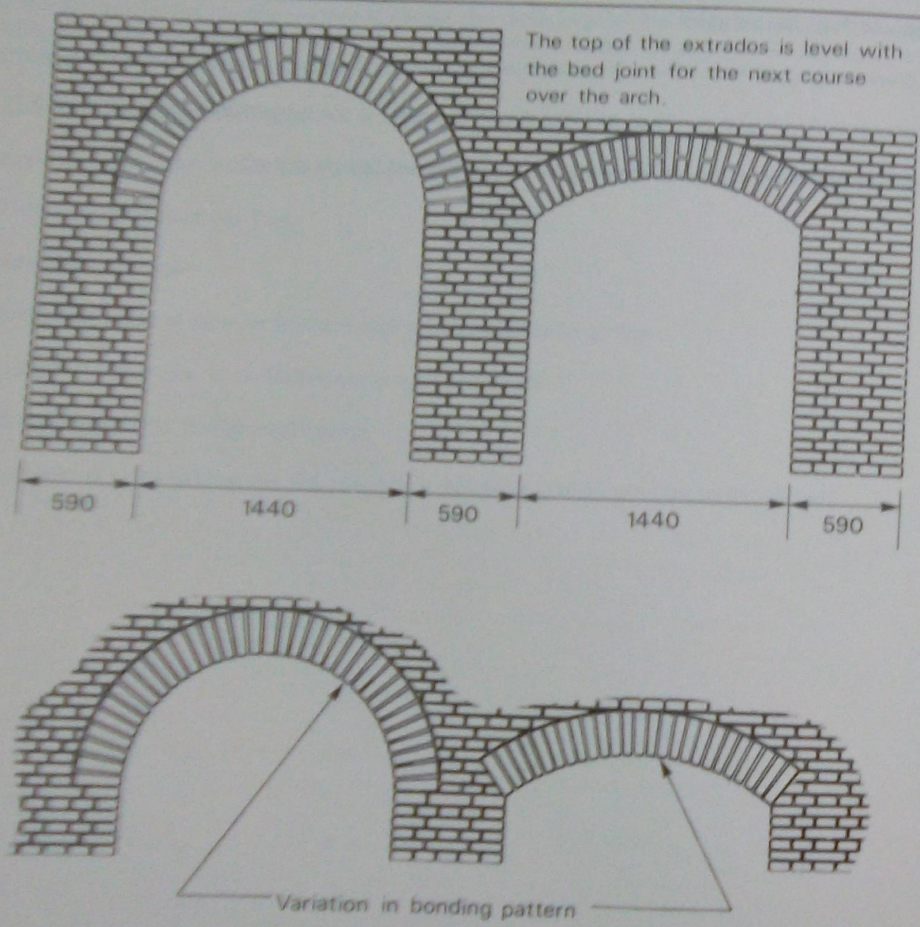
18 EXERCISES IN BUILDING ARCHES

18.1 GENERAL

Where conditions allow, training areas should be set up where the abutments required for the building of arches feature as a permanent fixture up to the springing line. This saves valuable time which can be devoted solely for arch construction and other activities in a bricklaying course. Three abutments in line would suffice.

If this is not possible, then as an additional exercise, preferably by a group, the abutments can be constructed as part of the whole exercise.

The necessary centering for the types of arches to be built on these abutments must be available and it is valuable practice for trainees to be made to locate them accurately and securely before constructing the arches.



ARCH BUILDING EXERCISE – SUGGESTED SIZES

In general, the bricklayer will be told whether and which arches are to be rough or gauged.

For rough (ungauged) arches he will be given the following information:

- The length of the intrados.
- The rise from the springline.
- The thickness of the wall.
- The number of rings in the height of the arch.

For gauged arches the bricklayer will be told:

- The length of the intrados.
- The height on the face of the arch.
- The width of the exposed portion of the soffit.
- The rise.
- The shape and type (e.g. semi-circular, segmental, relieving or otherwise).
- Whether purpose made bricks will be supplied.

To determine how many bricks are needed and to what size he has to cut them, the bricklayer can do any of the following?

- Do an actual full size lay out on the ground, or
- Draw up the details to scale, or
- Calculate the number and dimensions of the bricks for the arch (suitable only for semi-circular arches).

Remember also that, except for flat arches which are often supported on camber bars and for relieving arches as auxiliaries to lintels, as well as pointed arches (eg Gothic, which take a birdsmouth key), all other types have an odd number of bricks and a key placed centrally in the crown, that is, midway on the span. Therefore in any layout or calculation it is only necessary to find out the details in half the arch to arrive at the final answer by multiplying by two and adding one for the key.

18.2.1 Semi-circular and segmental rough (ungauged) arch.

Possibly the quickest way to work out the number of bricks needed for this type is to calculate it rather than laboriously laying it out or scaling it.

Calculation example:

Suppose the length of the intrados is given as 2266 mm.

Remember we have only to consider half the arc less half a brick (the key).

If the intrados length is then 2266 ÷ 2 = 1133 mm.

Now subtract half a brick height (76 ÷ 2 = 38 mm), we then 1133 − 38 = 1095 mm left for one side of the arch and it is on this length that a number of bricks and joints have to be fitted and assuming we start a 10 mm joint at the soffit, then 1 brick + 1 joint = 86 mm. Now divide 1095 by 86: $\frac{1095}{86} = 12.7$ bricks.

Say 13 bricks and this means that the joints will have to be somewhat less than 10 mm.

The arch therefore requires 13 + 13 + 1 = 27 bricks and there will be 26 joints.

For accurate work, you are now able to determine the size of each joint to rather close limits:

27 bricks amount to 27 × 76 = 2052 mm

Intrados length is 2266 mm, leaving 2266-2052 = 214 mm for 26 joints, or 104 ÷ 26 = 76 mm per joint, that is between 7 and 8 mm joints at the intrados.

If the length of the intrados is not given and you are dealing with a semi-circular arch, provided the span or rise is given, it is possible to calculate the length of the intrados, which is nothing but half the circumference of the circle with a radius equal to the rise (or half the span).

Suppose the span equals 1440 mm, then the rise must be 1440 ÷ 2 = 720 mm.

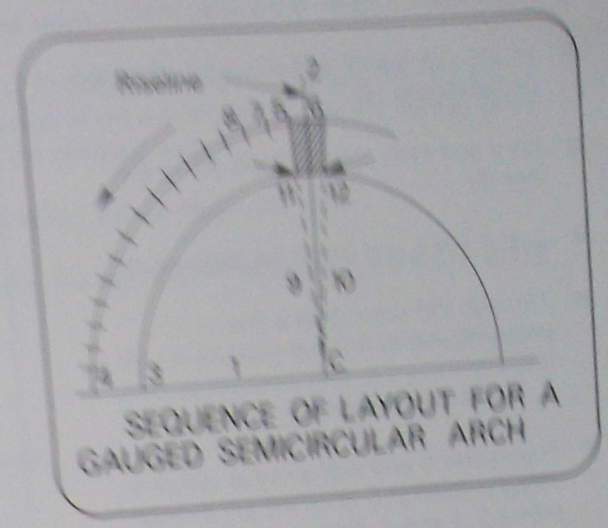
The circumference of a circle equals:

$2 \pi R$ or $2 \times \frac{22}{7} \times R$ (R is the radius)

then the length of the arc of half a circle must be: πR or $\frac{22}{7} \times R$

In our example: $\frac{22}{7} \times 720 = 22 \times 103 = 2266$ mm

and this is the length of the intrados.



... proceed as follows:

... a straight line with chalk on a ... flat floor (1).

... a point C and from there and with ... of a builder's square draw a line ... perpendicular to the first line.

... on the end of a radius rod located at C ... rail or a string with chalk or pencil ... one end, draw the semicircle (3). The ... also is of course equal to the rise. This ... represents the intrados.

... from point 3 mark off the size of the ... joint (4).

... your the radius rod or string to that new radius (C-4) and scribe another arc as shown. (This ... notes the extrados line).

... either side of the rise line, mark off the size of half the actual size of one brick height (38 mm) ... establish points 5 and 6.

... step off from 5 along the extrados the height of one brick plus 1 joint in succession, until point 4 ... reached.

— You may need to make slight adjustments to ensure whole brick heights fit in the space.

— You can of course work from point 6 in a clockwise direction on the other part of the arc.

... now only have to count the number of bricks so found, multiply by two and add the key to arrive ... the total number of bricks for the arch.

To arrive at the size of the brick, in case machine cutting is required, proceed as follows:

- Joint 5 and 6 to C. Where the lines intersect arc 3, (giving points 11 and 12) the dimension of the arris at that point can now be measured and all bricks cut to the size indicated by the trapezium 5-6-12-11.

3 Layout for segmental arch — full size

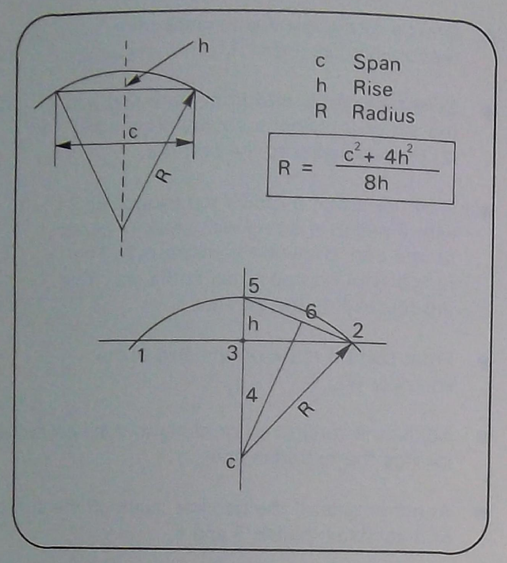
Geometry method

... is slightly more involved as the radius is not readily known.

... can be found by calculation using the formula shown on the illustration, or it can be constructed ... geometrical methods.

Given the span and the rise, we can find the centre of the circle and therefore the radius R which, if circled from C, will go through the springing points and the crown.

- Draw line 1-2 equal to the span width.
- Bisect that line (3) and through it draw the perpendicular (4).
- On it and from point 3, mark off 'h' the rise (5).
- Join 5 and 2 and bisect the distance (6).
- Through this point draw a line perpendicular to 5-2 and produce it until it intersects line 3-4. This establishes point C, the centre of the circle.
- From point C and with a radius rod or a string pivoted at C draw the arc through points 2, 5 and 1, distance C-2 being the radius.
- From then on you can proceed as for the semi-circular arch in determining the number of bricks required and their size.



Calculation method

With this method, you still would have to draw up line 1-2, 3-4 and establish point 5. Now, using the formula, and for example 1440 mm as span and 250 mm as rise, we would get:

$$R = \frac{C^2 + 4h^2}{8h} = \frac{(1440)^2 = 4 \times (250)^2}{8 \times 250}$$

$$= \frac{2\,073\,600 + 4 \times 62\,500}{2000}$$

$$= \frac{2\,073\,600 + 250\,000}{2000}$$

$$= \frac{2\,323\,600}{2000}$$

$$= \frac{23\,236}{20} = 1161.8 \text{ mm (say 1162 mm)}$$

From either point 2 or point 1 circle this distance until it intersects the line 3-4; this gives point C, the centre of the circle and from there draw the arc through 2, 5 and 1 with the radius found.

After that, the process is the same as for the semi-circular arch for arriving at the number of bricks and their size.

NOTE:
Time can be saved by placing the centering on the floor and drawing the line of the intrados on the floor before locating the centering between the abutments and when working out the number of bricks and size along the arch line so drawn.

C Calculating for a gauged semi-circular arch.

To do this we must know the length of the extrados. The length of the intrados and the rise are always given, and therefore we always know the radius of the arc. In addition we are always given the height of the arch face and therefore the radius of the extrados arc.

Even if the rise is not given, there are two ways by which we can determine it:

- It is half the span anyway, and if this is not given, we can find the radius from the length of the intrados since,
- The length of the arch equals π R or $\frac{22}{7} \times R$

Suppose the intrados length equals: 2266 mm, then

$$L = \frac{22}{7} R$$

or $2266 = \frac{22}{7} R$ then

$$R = \frac{2266 \times 7}{22} = 721 \text{ mm (say 720 mm)}$$

Having found the radius for the intrados we can now, knowing the face height of the arch, find the length of the extrados becomes:

Let the arch face be 230 mm, then the radius of the extrados becomes: $720 + 230 = 950$ mm and the length of the extrados:

$$L = \frac{22}{7} \times R$$

$$= \frac{22}{7} 950 = 2985.7 \text{ mm (say 2986)}$$

Half that length equals $\frac{2986}{2} = 1493$ mm

Subtract half a brick height (the key) (38 mm) leaves 1455 mm.

Assuming a 10 mm joint we will find that in this length we can fit:

$$1455 \div 86 = 17 \text{ bricks}$$

but with joints a little less than 10 mm (Total 35 bricks). These 35 bricks have to be cut to a taper to fit along the intrados line with their lower arrises.

Now, the intrados length equals 2266 mm into which must fit 35 bricks and 36 joints, or 35 bricks and 35 joints if we subtract the size of one last joint at the springing point.

This leaves us with 2266 − 10 = 2256 mm.

It is in this intrados length that we have to fit 35 bricks plus 35 joints. Therefore dividing the length by 35 will give us the dimension of 1 arris plus 1 joint.

We then get: 2256 − 35 × 64.5 mm

This means there is a difference in size between the top arris and the bottom one of some:

86 − 64.5 = 21.5 mm (say 22 mm),

and therefore the face of each brick has to be reduced by 22 − 2 = 11 mm at each side on the line of the intrados and tapering to full size at the extrados line.

We end up with a brick showing a symmetrical trapezium shaped stretcher face of 76 × 54 × 230 mm high.

- Select the required number of bricks and match them for size.
- Accurately measure and mark the areas to be cut.
- Machine cut the bricks to the required size.

WARNING:
Wear goggles when machine cutting

18.3 CONSTRUCTING THE ARCH (SEMI-CIRUCLAR)

Having cut bricks to size and stored them out of harms way: (see para 13.4)

- Locate and secure the centering supports;
- Locate the centering on the folding wedges previously placed on the supports bearers;
- Align the centering, square it by adjusting the wedges and make sure the dimension for the rise is correct;
- Secure the centering.

Assuming the necessary scaffolding (if any) is in place and your workpost adequately organised, proceed with the construction of the arch:

- Mark off the location of each joint on the intrados line of the centering making sure the key is located centrally in the arch.
- Accurately lay two or three courses on one side of the arch making sure the centre line of the brick faces and the joints coincide with the radius of the arch.
  - This can be done with a marked radius rod pivoted at the centre of the springing line on the centering or by a string fastened at that point.
- Repeat the procedure on the other side of the arch and ensure that the top corner of each voussoir is on the same horizontal line as that of the corresponding voussoir on the other side.

  - Check frequently with line or board with spirit level.
- Continue in this fashion until you reach the stage for locating and placing the key which should end up dead centre.
- Point the joints to the type specified and clean the brickwork.
- Check carefully the vertical distance between the spinging line and top of the key, then calculate the number of courses needed and arranged so that the last course of the spandril comes level with the top of the key.
- Stretch a line for the first horizontal course to be laid on the abutment.
- Complete the spandrils and the remainder of the brickwork to 1 course of headers over the extrados as shown in the illustration.
- Point all joints and clean the brickwork.

NOTE:
Similar procedures can be adopted to construct the segmental arch.
Alternatively, two semi-circular and identical arches can be built by a team, or two segmental arches, or one of each along the same lines as indicated.
Variations of bonding can also be introduced over a series of exercises.

NOTES

19 COPINGS AND CAPS

A coping is a cover on top of an external wall, parapet or balustrade. Its main purpose is to prevent the entry of water into the mass of the brickwork through the top course, although by its execution it helps in improving the appearance of the whole.

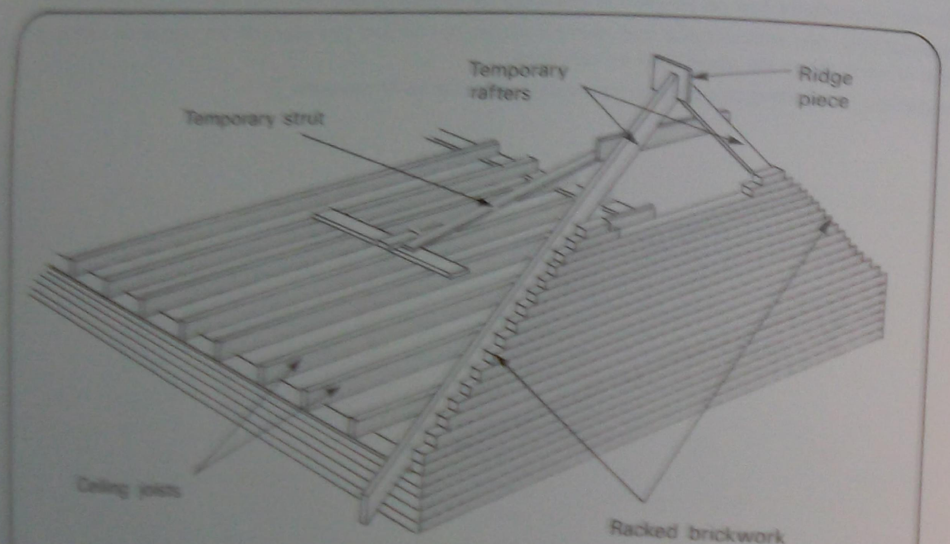
Copings can be made in brick in various course patterns (soldier course, on edge course) or concrete, metal or in glazed terra cotta tiles of various sizes, shapes and colours. Purpose made capping bricks to specified shapes or sizes can also be used.

Caps are used as a covering on isolated piers and the materials used in them and their purpose is the same as for copings.

Both caps and copings should be set in cement mortar.

20 GABLE ENDS AND PARAPET WALLS

Gable ends may have to be built before the roof is framed. Because the brickwork to be built is subject to wind pressure, it is necessary to provide a temporary support.



METHOD OF CONSTRUCTING A GABLE

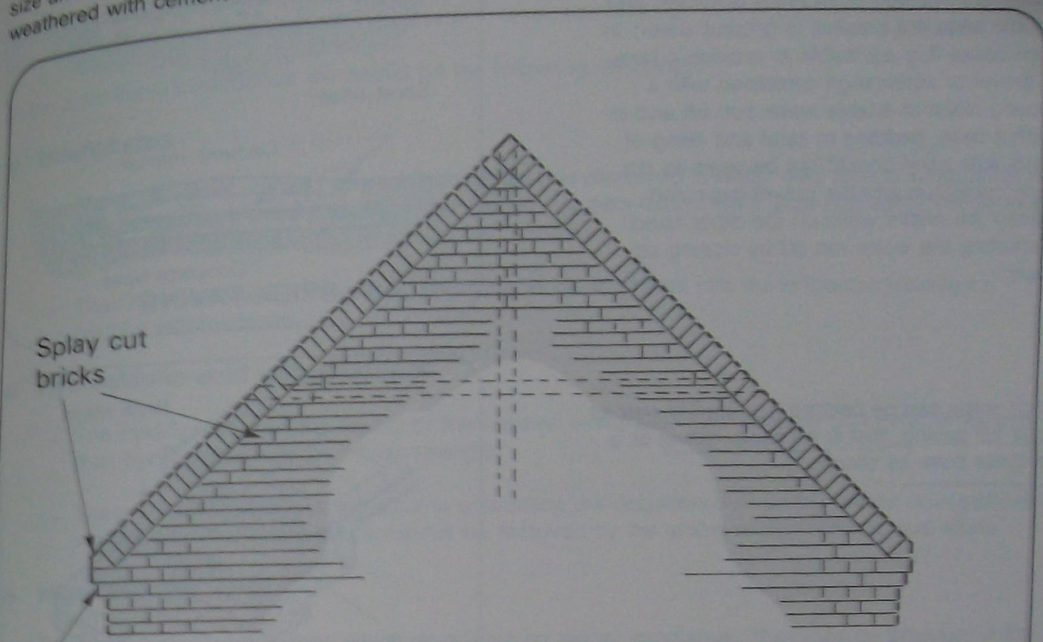
In consultation with the carpenter, the rake of the gable is worked out and he will erect two temporary rafters as guides to the brickwork and secure the rafters as guides to the brickwork.

The raking of the gable walls can be finished as a flush gable or under the overhang of the roof.

In the case of a flush gable end, the brickwork may be finished with splay cut bricks to the rake of the gable, with a course of headers, bricks on edge or in some ornamental pattern.

Larger type of gable walls sometimes need to be constructed with attached piers to give them stability.

Parapet walls are also subject to wind pressure and they too should be stiffened with attached piers, size and intervals of which depend on height and length of the parapet. Parapet tops may be weathered with cement mortar or finished with a suitable coping.



EXAMPLE OF FLUSH GABLE END WITH BRICKS ON EDGE FINISH

21 BRICK PAVING AND STEPS

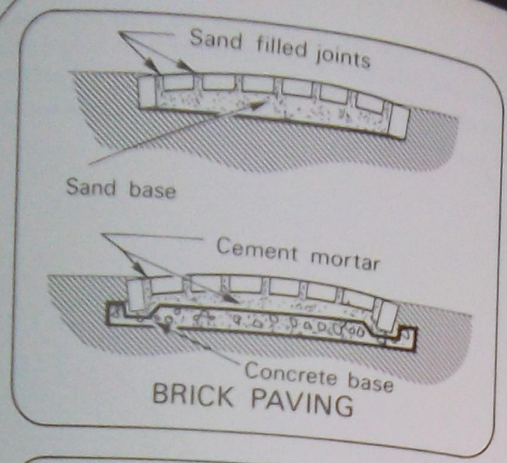
Bricks are used for paving footpaths, terraces, etc. Where only foot traffic occurs, the bricks may be laid on a sand base and the joints filled with sand, or grouted with cement mortar. Where heavier than foot traffic is expected to occur, a concrete base is needed which is sufficiently strong to carry the required loads. The bricks are then bedded into a cement mortar bed and the joints filled as in normal brickwork or grouted later.

Because of the low porosity and greater resistance to wear it is best to use strong mortars for this purpose, e.g. 1:0-1/4:3 or 1:1/2:4, and to iron the joints to a smooth hard finish.

Moisture coming up from below or seeping in from the surface may cause efflorescence with the danger of salt attack very detrimental to the brick material. It may also make the surface slippery and encourage the growth of fungi and mosses.

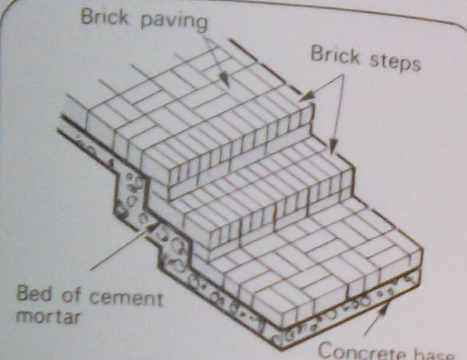
These two conditions can be overcome by providing an impervious layer below the brick mortar, such as polyethylene sheeting or a bituminous layer as a barrier against rising moisture. Surface water can be made to run off quickly by providing the surface with a crown or a slope. The slope should be some 3 mm in 300 mm minimum, increasing to 6 mm in every 300 mm for large surfaces and possibly edged by gutters.

It is of course best to select bricks which are known to be resistant to salt attack, especially where bricks would be laid on poorly drained soil or where it is known that soluble salts are present in ground water. In such cases it is advisable to provide a layer of gravel or screenings combined with a ground slope to enable water run off and in such a case, bedding in sand and filling of joints with sand should not be used as dry sand could run into the gravel gaps and loosen the bricks while on the other hand restricting the water run off by closing up gaps.



BRICK PAVING

Brick steps can be bedded in a similar way as done for paving, that is on sand, gravel or a concrete base as shown.



BRICK STEPS

Alternatively it may be entirely built of bricks bedded onto a concrete slab previously poured. Strong mixes should be used for the joints.

The illustration shows a great variety of patterns that can be used effectively for paving.

22 CLEANING OF BRICKWORK

Brickwork may need cleaning after construction for a variety of reasons such as:

- Mortar droppings and smears left on new work.
- Staining occurring from chemical reactions within the brickwork.
- Staining occurring from sources outside the brickwork.

22.1 MORTAR DROPPINGS ON BRICKWORK

The best way to minimise having to clean up brickwork after construction is for the bricklayer to keep his work free from mortar droppings and smears to the greatest possible extent. This is especially important where coloured mortar is used with smooth extruded bricks; the pigments used in coloured mortar are often very difficult to remove.

22.1.1 Proprietary cleaning compounds

There are various proprietary cleaning compounds which can be used for cleaning brickwork. They should be used according to the manufacturers' recommendations.

In the main these compounds are based on the following chemicals:

- **Bisulphates**
  - These generally come in powder form and when dissolved in water they form a weak sulpheric acid of relatively low acidity. It is less dangerous than hydrochloric acid and acts more slowly on mortar droppings.
  - Their main drawback is that they could introduce sulphates into the brickwork leading to harmful efflorescence.
- **Hydrochloric acid with modifers**
  - The modifiers reduce the acidity of the solution which acts less severely on mortar droppings than hydrochloric acid of similar strength.
  - These modifiers are also effective in preventing the occurrence of certain stains or in removing various forms of stains which cannot be removed by the action of hydrochloric acid alone.
- **Hypochlorites**

  These form alkaline solutions which do not act on mortar droppings. They may be effective in the removal of vanadium and timber stains on brickwork.

22.1.2 Hydrochloric acid

Used in diluted form it is the most commonly used for the cleaning of new brickwork. This acid, also known as muriatic acid or spirits of salt is highly corrosive, dangerous to handle and great care is needed in its use.

For cleaning brickwork, it is used in a solution of 1 part acid to 20 parts water; more rapid action on mortar results from using a higher concentration which should NEVER exceed 1 part acid to 10 parts water for cleaning brickwork. The acid dissolves lime and cement from the mortar which disintegrates and can be washed away. Obviously, care must be taken not to subject mortar joints to acid attack, especially to stronger than recommended solutions as not only are such solutions highly detrimental to mortar but may result in ruined brickwork as the acid stains or burns the bricks.

Manganese bricks, and more so the smooth type, are particularly susceptible to damage by strong acid solutions.

Preparing the solution

Observe the following precautions at all times when handling acids or preparing and using their solutions:

- Wear goggles, rubber gloves, boots and apron.
- Use only earthenware, glass or plastic containers.
- Handle containers with extreme care.

WARNING:
Never pour water on concentrated acid.
Carefully add the measured amount of acid to the required amount of water (1/2 litre to 10 litres of water).

Cleaning the brickwork

- Use only a stiff fibre or plastic brush — not bristle or wire.
- Wear the same protective clothing as for making up the solution.
- Protect adjacent materials (timber, metal or polished stone) from acid splashes by shielding or by drenching before, during and after brickwork cleansing.
- Rub the brickwork down with a stiff brush and with a piece of wood, brick or carborundum remove large lumps of mortar.
- Drench the brickwork with clean water to remove loose dirt and to reduce the suction of the brickwork.
- With a stiff scrubbing brush, apply the cleaning solution to some 1 to 2 square metres to the thoroughly wetted wall area.
- Concentrate on the brick faces to lessen the effects of the acid on the mortar joints.
  - — Keep the bricks wet to ensure that neither acid nor its reaction products with the mortar are drawn into the brickwork, otherwise streaking of the surface can occur.
- Hose down the cleaned section immediately.
- Repeat the process over the remainder of the brickwork working down from the top of the wall.
- Mop up excess water with rag or sponge.
  - — This improves the quality of the work and is important where textured bricks and raked joints are concerned.

If after drying out, the wall still shows marks that have been missed, they should be cleaned with the same solution and areas which have resisted treatment should be processed by more mechanical means (more scrubbing with the solution or by using a piece of timber, etc for scraping rather than by using stronger acid solutions.

22.2 STAINS ON BRICKWORK AND CLEANING METHODS

This can be the result of chemical processes taking place within the brickwork or caused by sources outside the brickwork.

22.2.1 Staining from within.

This usually shows up as:

- Efflorescence. Mostly a white powdery deposit, but it can be yellow, green or brown. It is the result of certain dissolved salts exuding from inside the brickwork and being left on the brick surface after the water in which they were dissolved has evaporated.

These salts deposits are always soluble in water and can be easily removed by a combination of brushing and washing down with fresh water. Adding acids or alkalines to the treatment of efflorescence does more harm than good as it may introduce additional salts which have to be removed again later.

NOTE:
Persistent occurrence of efflorescence is usually a sign that water is entering the brickwork. This could be ground water or water entering through faulty flashings or plumbing. This should be corrected to prevent salt attack and eventual destruction of the brickwork, especially in the case of lightly fired bricks.

- Vanadium stains

These appear as a yellow, green or reddish-brown discolouration on bricks made from light coloured clays. The stains are not harmful or permanent. In exposed positions, the rain will eventually wash them off.

If they must be removed, do NOT use hydrochloric acid which may turn them black and more difficult to remove.

Chemical removal of vanadium stains is a matter of trial to arrive at the most effective method. Such methods can be:

Oxalic acid treatment

- — Washing the wall with an oxalic acid solution of 95-185 millilitres of acid to 5 litres of water and preferably applied hot for quick results.
- — When the stain has bleached, apply a solution of 60 millilitres of washing soda per 5 litres of water and allow this solution to remain on the wall.

Hypochlorite treatment

- — Use a household bleach based on hypochlorite at full strength. Apply it to the wall and complete the treatment with the solution of washing soda as used after the oxalic acid treatment.

Alkaline treatment

- — Wash the wall with a solution of caustic soda, washing soda or waterglass to a strenmgth of 600 grams to 5 litres of water.
- — Using these solutions may result in the appearance of efflorescence which can be removed in the normal way.
- — The same strength solutions of potassium hydroxide, potassium carbonate or potassium silicate can be used if available. Secondary efflorescence is less likely to occur with these.

23 CODES, STANDARDS AND SOURCES OF INFORMATION

23.1 CODES AND STANDARDS

SAA — A21 — Burnt clay and shale bricks

SAA — CA47 — Rules for brickwork in building (SAA Brickwork Code)

SAA — AS91 — Sand-lime (Calcium Silicate) bricks

SAA — CA32 — Rules for the use of concrete blocks in masonry construction (SAA Code for Concrete Block Masonry)

SAA — A123 — Mortar for masonry construction

SAA — A3 — Quicklime

SAA — A4 — Hydrated lime

SAA — Int 324 — Metal Wall ties for brickwork

SAA — Int 326 — Bituminous Damp-proof courses with metal centre

SAA — Int 327 — Bituminous Damp-proof courses with fibre felt base.

23.2 SOURCES OF INFORMATION

Much valuable information, technical notes, data, bulletins may be obtained on application, and in some cases for the payment of a small fee, from:

1. Building Research Liaison Service, Australian Government Department of Housing and Construction, 17 Yarra Street, Victoria, 3122.
2. C.S.I.R.O. Division of Building Research, Graham Road, Highett, Victoria, 3190.
3. Brick Development Research Institute, University of Melbourne, Parkville, Victoria, 3052.

NOTES FOR THE INSTRUCTOR

In these Basic Trade Manuals the Term 'instructor' refers to any person who may train or be directly responsible for training individuals.

For example, the task of instructing may be the sole or shared responsibility of:

- skilled tradespeople;
- leading hands;
- foremen;
- works instructors;
- apprentice trainers;
- works managers.

INITIAL PLANNING

A
- Analyse the training requirements of a newcomer, considering that the person:
  - May have no previous experience in the subject
  - Will need to do productive work as soon as possible.
- Analyse what the trainee must learn about:
  - The tools to use for the subject.
  - The terminology involved in the subject.
  - Basic working methods.
- Analyse what will be the first productive work you will be able to give the trainee.

B
- Decide if your trainees need information to supplement that given in this manual.
- Decide if or when additional training material or exercises will be required to improve on the skill gained.

C
- Plan the explanations, demonstrations and the practice required by the trainee, preferably on an individual basis, if numbers allow.

USING THE MANUAL

It may be of assistance to the trainee to arrange for short periods of learning followed by short periods of practice in applying the knowledge gained.

To keep interest alive, it will be useful to relate, as much as possible, the material treated in this manual with actual practical applications in the field.

PRACTICAL EXERCISES AND PROJECTS

Some project exercises are included in this manual. Other exercises and projects which involve the application of the skills gained may of course be added as considered necessary.

There may be areas and tasks in actual construction where the developing skills of the trainee can be put to effective productive use at any stage during the period he or she is learning the subject. Such possibility should be carefully considered and used to the full for the trainee's benefit as well as that of the firm.

TRAINING RECORDS

Simple training records will help in planning training. Record the parts of each manual as it is covered. Make brief notes on the trainee's progress. Record your assessment of the successive skills developed by the trainee. Draw up a simple record card to suit your needs.

Using records helps to pin-point the trainee's strengths and weaknesses. They ensure that training in the essential fundamentals is not missed. Training records can be used to help co-ordinate on-the-job training and technical school learning. Where trainees have to serve a probationary period, records assist in the assessment of the trainee's progress.

PUBLICATIONS IN BASIC TRAINING MANUALS — BRICKLAYING

Title	
13-1	FUNDAMENTALS
13-2	OPERATIONS

OTHER PUBLICATIONS IN BASIC TRAINING MANUALS
(Available at date of printing)

METAL TRADES FITTING	10 MANUALS
WORKSHOP SAFETY	1 MANUAL
PRACTICAL GEOMETRY	3 MANUALS
LATHE WORK	7 MANUALS
SHAPING AND SLOTTING	3 MANUALS
GRINDING	3 MANUALS
MILLING	4 MANUALS
ARC WELDING	4 MANUALS
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