BRICKS

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Introduction

- The bricks are obtained by moulding clay in rectangular blocks of uniform size and then by drying and burning these blocks.
- As the bricks are of uniform size they can be properly arranged and further, as they are light in weight, no lifting appliance is requires for them.
- The bricks do not require dressing, and the art of laying bricks is so simple that the brickwork can be carried out with the help of unskilled labourers. Bricks replaces stone where stones are not easily available and a plenty of clay suitable for manufacture of bricks is available.
- The common brick is one of the oldest building material and it is extensively used at present as a leading material of construction because of its durability, strength, reliability, low cost, easy availability etc.,
- They were initially hand made and used as load bearing material for various structures. With the passage of time the production of burnt clay bricks on a scientific and modern basis including proper mining of clays can lead to the availability of quality bricks.

Ground Molded Bricks

Fig.: Ground moulding

Table Moulded Bricks

Fig.: Table moulding

Comparison of STONE WORK & BRICK WORK

STONE WORK	BRICK WORK
➢ The places where stones are easily available the stonework is cheaper than brickwork.	➢ The places where plenty of clay available the brick work becomes cheaper then stone work.
➢ The cost of construction works out to be more than brickwork.	➢ The cost construction works out to be less.
➢ Skilled labour required for construction.	➢ Less skilled labour required in the construction.
➢ The brickwork does not create a solid appearance in relation to the stonework and hence, for public buildings and monumental structures, the stonework is found to be more useful than brickwork.	➢ It is easy to construct connections and openings in case of brickwork than stone work.
➢ Stones has less resistance to fire.	➢ The bricks resist fire hence they do not easily disintegrate in case of a fire.
➢ Less resistance to atmospheric effects.	➢ The bricks of good quality resist the various atmospheric effects in a better way.
➢ The stonework is stronger than the brickwork	➢ In case of brickwork, the mortar joints are thin and hence the structure become more durable.
➢ The stonework can't absorb the moisture from the atmosphere hence it is water tight. Very less dampness enter the building.	➢ The bricks absorb moisture from the atmosphere and dampness can enter the building. So brickwork is less watertight.

CLASSIFICATION OF BRICKS

The bricks can broadly be divided into two categories as follows :

i) Unburnt or Sun – dried bricks and

ii) Burnt bricks

The unburnt or sun – dried bricks are dried with the help of heat received from sun after the process of moulding. These bricks can only be used in the construction of temporary and cheap structures. Such bricks should not be used at places exposed to heavy rains.

The bricks used in construction works are burnt bricks and they are classified into the following four categories:

(1) First Class Bricks (2) Second Class Bricks

(3) Third Class Bricks (4) Fourth Class Bricks

(1) First Class Bricks :

- **These bricks are table – moulded and of standard shape and they are burnt in kilns.**
- **The surfaces and edges of the bricks are sharp, square, smooth and straight.**
- **They comply with all the qualities of good bricks and are used for superior work of permanent nature.**

(2) Second Class Bricks :

- **These bricks are ground – moulded and they are burnt in kilns.**
- **The surface of these bricks is somewhat rough and shape is also slightly irregular.**
- **These may have hair cracks and their edged may not be sharp and uniform.**
- **These bricks are commonly used at plates where brickwork is to be provided with a coat of plaster.**

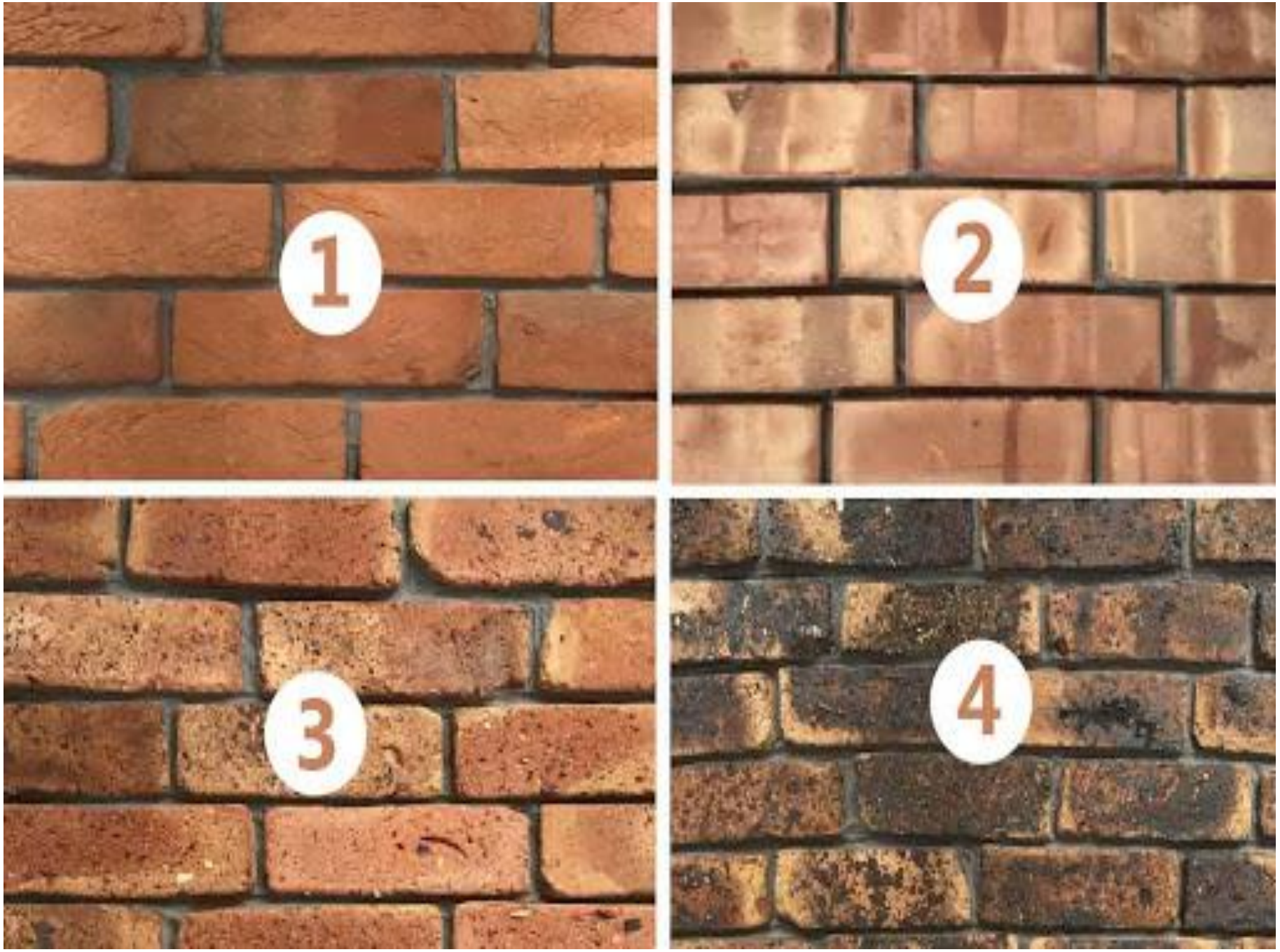
(3) Third Class Bricks :

- **These bricks are ground – moulded and they are burnt in clamps.**
- **These bricks are not hard and they have rough surfaces with irregular and distorted edges.**
- **These bricks give dull sound when struck together.**
- **They are used for unimportant and temporary structures and at places where rainfall is not heavy.**

(4) Fourth Class Bricks :

- **These are over burnt bricks with irregular shape and dark colour.**
- **These bricks are used as aggregate for concrete in foundations, floors, roads et., because of the fact that the over burnt bricks have a compact structure and hence they are sometimes found to be stronger than even the first class bricks.**

Note : The above classification of bricks is based on the method of manufacturing or preparing bricks.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USES OF BRICKS

- The ***first class and second class bricks*** are widely used for all sorts of sound work especially of permanent nature. These structures include buildings, dams, roads, sewers, bridge piers, tunnels, pitching works etc.,
- The use of ***first class bricks*** is specified for obtaining the architectural effects on faces of structures where they are to be kept expose for beauty.
- The ***masonry with second class bricks*** is generally plastered to make the smooth surface obtained due to the irregular shape and size of bricks. The mortar required in brick masonry using second class bricks will also be more.
- The ***third class and sun – dried bricks*** are used for construction work of temporary nature. These bricks are not used in damp situations or at places subjected to heavy rains.
- The ***fourth class bricks*** are used as road metal and as aggregates in the foundation concrete.

SIZE AND WEIGHT OF BRICKS

- The bricks are prepared in various sizes. The custom in the locality is the governing factor for deciding the size of a brick. Such bricks which are not standardized are known as ***traditional bricks.***
- If bricks are large, it is difficult to burn them properly and they become too heavy to be placed with a single hand. On the other hand, if bricks are small, more quantity of mortar is required.
- For India, a brick of standard size **190 mm X 90 mm X 90 mm** is recommended by the BIS. ***With mortar*** thickness, the size of such a brick becomes **200 mm X 100 mm X 100 mm** and it is known as ***nominal size of the modular brick***. Thus the nominal size of brick includes the mortar thickness.
- It is found that the weight of 1m3 (Unit volume) of brick earth is about 18 kN. Hence the average weight of a brick will be about 30 to 35 N.

COMPOSITION OF GOOD BRICK EARTH

The *constituents* of good brick earth are

1) ***Alumina :*** It is the chief constituent of every kind of clay.

   A good brick earth should contain about ***20% to 30 %*** of alumina.

   This constituent ***imparts plasticity*** to the earth so that it can be moulded.

   If alumina is present ***in excess***, with inadequate quantity of sand, the raw **bricks shrink and warp** during drying and burning hence become too hard when burnt.

2) ***Silica*** **:** It exists in clay either as free or combined.

   As free sand, it is mechanically mixed with clay and in combined form, it exists in chemical composition with alumina.

   A good brick earth should contain about ***50% to 60%*** of silica.

   The presence of silica ***prevents cracking, shrinking and warping*** of raw bricks. Thus imparts uniform shape to the bricks.

   The ***durability*** of bricks depends on the proper proportion of silica.

   The ***excess of silica destroys the cohesion*** between particles and the ***bricks become brittle***.

3) ***Lime*** **:** A small quantity of lime not exceeding ***5%*** is desirable in good brick

The lime ***prevents shrinkage*** of raw bricks. The sand alone is infusible. But it slightly fuses at kiln temperature in presence of lime. Such fused sand works as a hard cementing material for brick particles.

The ***excess of lime*** causes ***brick to melt*** and hence its shape is lost.

The lumps of lime converted into quick lime after burning and this quick lime slakes and expands in presence of moisture. Such an actions results in splitting of bricks into pieces.

4) ***Oxide of Iron*** **:** A small quantity of oxide of iron to the extent of about 5% to ***6%*** is desirable in good brick earth.

It helps as lime to fuse sand. It also ***imparts red colour*** to the bricks.

The ***excess*** of oxide of iron makes the ***bricks dark blue or blackish***. If the quantity is comparatively ***less***, the bricks will be ***yellowish in colour***.

5) ***Magnesia*** ***:*** A ***small quantity*** of magnesia in brick earth imparts ***yellow tint*** to the bricks and ***decrease shrinkage***. But ***excess*** of magnesia leads to the ***decay of bricks***.

HARMFUL INGREDIENTS IN BRICK EARTH

1) ***Lime :*** Excess lime leads to the formation of lumps.

2) ***Iron Pyrites :*** If iron pyrites present in brick earth, the bricks are crystallized and disintegrated during burning because of the oxidation of the iron pyrites.

3) ***Alkalies :*** These are mainly in the form of soda and potash.

   The alkalies cause bricks to fuse, twist and warp. As a result, the bricks are melted and they loose their shape.

   Further, the alkalies remaining in bricks will absorb moisture from the atmosphere, when bricks are used in masonry. Such moisture, when evaporated, leaves behind grey or white deposits on the wall surface. The appearance of the building as a whole is then seriously spoiled.

4) ***Pebbels :*** The presence of pebbels or grits of any kind is undesirable because it will not allow the clay to be mixed uniformly and thoroughly which will result in weak and porous bricks. Also, the brick containing pebbels will not break regularly as desirable.

5) ***Vegetation and Organic Matter :*** The presence of organic matter and vegetation assists in burning. But if such matter is not completely burnt, the bricks become porous. This is due to the fact that the gases will be evolved during the burning of the carbonaceous matter and it will result in the formation of small pores. Hence it is necessary to see that all these gases are removed during the process of burning for getting bricks of good quality.

QUALITIES OF GOOD BRICKS

The good bricks which are to be used for the construction of important structures should posses the following qualities :

- ✓ The bricks should be table – moulded, well – burnt in kilns, copper – coloured, free from cracks and with sharp and square edges. The colour should be uniform and bright.
- ✓ The bricks should be uniform in shape and should be of standard size.
- ✓ The bricks should give a clear metallic ringing sound when stuck with each other.
- ✓ The bricks when broken or fractured should show a bright homogeneous and uniform compact structure free from voids.
- ✓ The brick should not absorb water more than 20 % by weight for first class and 22 % for second class bricks, when soaked in cold water for a period of 24 hours.

- ✓ The bricks should be sufficiently hard. No impression should be left on brick surface, when it is scratched with finger nail.
- ✓ The bricks should not break into pieces when dropped flat on hard ground from a height of about one metre.
- ✓ The bricks should have low thermal conductivity and they should be sound – proof.
- ✓ The bricks, when soaked in water for 24 hours, should not show deposits of white salts when allowed to dry in shade.
- ✓ No brick should have the crushing strength below 5.50 N/mm2.

TESTS FOR BRICKS

- A brick is generally subjected to the following tests to find out its suitability for the construction work:

1) **Absorption :**

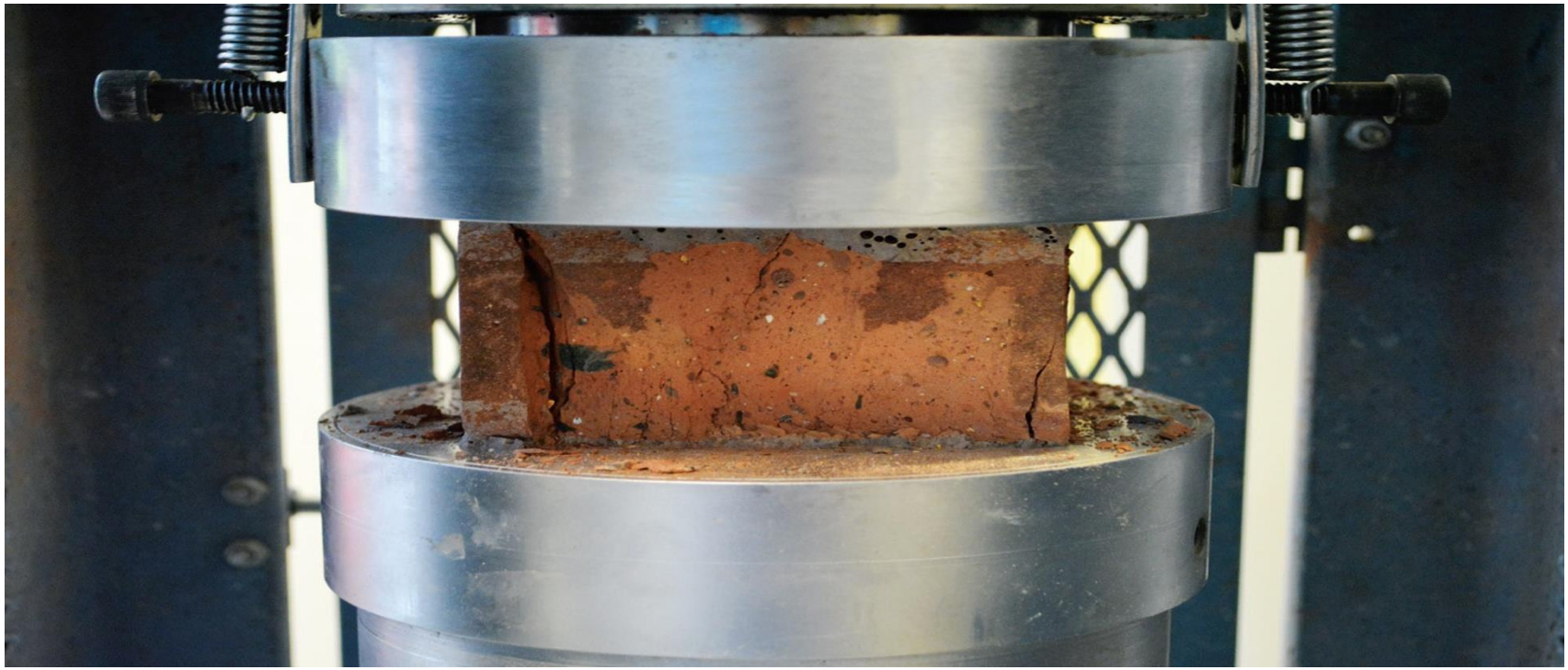
- ✓ A brick is taken and it is weighted dry.
- ✓ It is then immersed in water for a period of 16 hours. It is weighed again and the difference in weight indicates the amount of water absorbed by the brick.
- ✓ It should not, in any case, exceed 20 % of weight of dry brick.

2) Hardness :

- ✓ In this test, a scratch is made on brick surface with the help of a finger nail.
- ✓ If no impression is left on the surface, the brick is treated to be sufficiently hard.

3) Crushing Strength :

- ✓ The crushing strength of a brick is found out by placing it in a compression testing machine.
- ✓ It is pressed till it breaks.
- ✓ As per BIS : 1077 – 1992, the minimum crushing or compressive strength of bricks is 3.50 Mpa, The bricks with crushing strength of 7 to 14 Mpa are graded as A and those having above 14 Mpa are graded as AA.



4) Presence of Soluble salts[Efflorescence Test] :

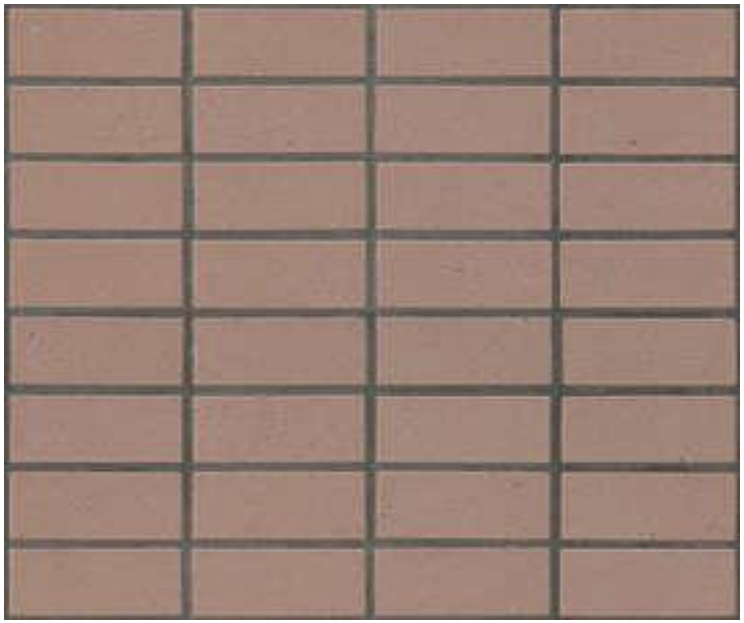
- ✓ The soluble salts, if present in bricks, will cause efflorescence on the surface of bricks.
- ✓ For finding out the presence of soluble salts in a brick, it is immersed in water for 24 hours, it is then taken out and allowed to dry in shade.
- ✓ The absence of grey or white deposits on its surface indicates absence of soluble salts.

Formation of white deposit on brick wall surface	Efflorescence
10 % of surface	Slight
50 % of surface	Moderate
> 50 % of Surface	Heavy and treated as serious

5) Shape and Size :

- ✓ In this test, a brick is closely inspected.
- ✓ It should be of standard size and its shape should be truly rectangular with sharp edges.
- ✓ For this purpose,20 bricks of standard size(190 mm X 90 mm X 90 mm) at random and they are stacked lengthwise, along the width and along the height.
- ✓ For good quality bricks, the results should be within the following permissible limits:

Length	3680 mm to 3920 mm
Width	1740 mm to 1860 mm
Height	1740 mm to 1860 mm



6) Soundness :

- ✓ In this test, the two bricks are taken and they are struck with each other.
- ✓ The bricks should not break and a clear ringing sound should be produced.

7) Structure :

- ✓ A brick is broken and its structure is examined.
- ✓ It should be homogeneous, compact and free from any defects such as holes, lumps, etc.,

MANUFACTURE OF BRICKS

Following considerations govern the selection of a brick field for the manufacture of bricks:

i. It should be linked up with the communicating roads so that the materials can be conveyed easily.

ii. It should be situated on a plain ground.

iii. It should be so selected that the earth for manufacturing good quality bricks is readily and easily available.

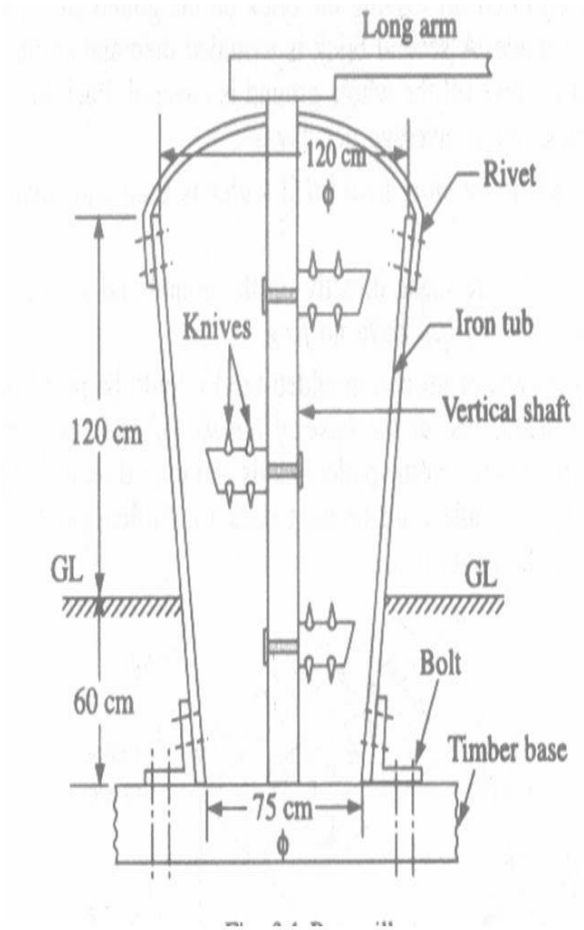
iv. It should offer all the facilities to the workers employed in the manufacturing process.

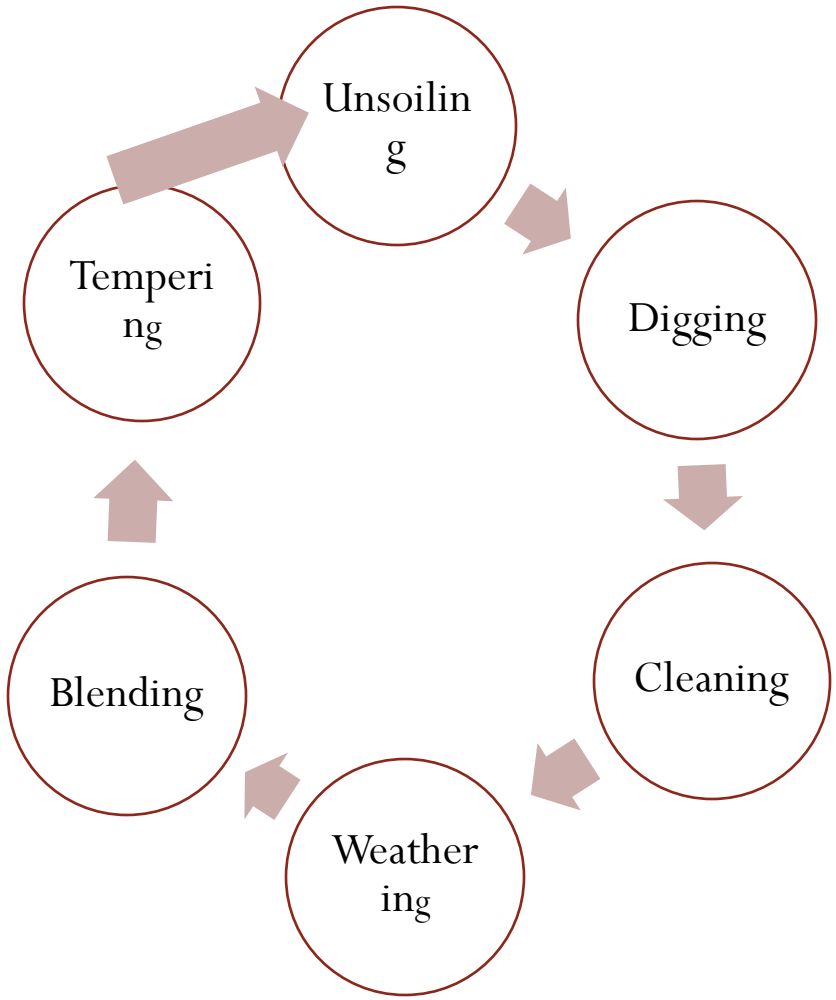
In the process of manufacturing bricks, the following four distinct operations are involved :

1) Preparation of clay
2) Moulding
3) Drying
4) Burning

1) **Preparation of Clay :** The clay for bricks is prepared in the following order.

Pug Mill





Unsoiling :

- The top layer of soil, about 200 mm in depth, is taken out and thrown away.
- The clay soil is full of impurities and hence it is to be rejected for the purpose of preparing bricks.

Digging :

• The clay is then dug out from the ground.

• It is spread on the levelled ground, just a little deeper than the general level of ground.

• The height of heaps of clay is about 600 mm to 1200 mm.

Cleaning :

- The clay, as obtained in the process of digging, should be cleaned of stones, pebbles, vegetable matter, etc.,
- If these particles are in excess, the clay is to be washed and screened.
- Such a process naturally will prove to be troublesome and expensive.
- The lumps of clay should be converted into powder from in the earth crushing roller.

Blending :

- The clay is made loose and any ingredient to be added to it, is spread out at its top.
- The blending indicates intimate or harmonious mixing.
- It is carried out by taking small portion of clay every time and by turning it up and down in vertical direction.
- The blending makes clay fit for the next stage of tempering.

Tempering :

- In the process of tempering, the clay is brought to a proper degree of hardness and it is made fit for the next operation of moulding.
- The water in required quantity is added to clay and the whole mass is kneaded or pressed under the feet of men or cattle.
- The tempering should be done exhaustively to obtain homogeneous mass of clay of uniform character.
- For manufacturing good bricks on a large scale, the tempering is usually done in a pug mill.
- If tempering is properly carried out, the good brick earth can then be rolled without breaking in small threads of 3 mm diameter.

MOULDING :

The clay which is prepared as above is then sent for the next operation of moulding. There are two ways of moulding :

1. Hand Moulding
2. Machine Moulding

1. Hand Moulding : In this, the bricks are moulded by hand i.e., manually.

- ✓ It is adopted where manpower is cheap and is readily available for the manufacturing process of bricks on a small scale.
- ✓ The moulds are rectangular boxes which are open at top and bottom. They may be wood or steel.
- ✓ Wooden mould is prepared with well seasoned wood. Steel mould is prepared from the combination of steel plates and channels.
- ✓ Steel moulds are more durable than wooden moulds and they are turn out bricks of uniform size.
- ✓ The bricks prepared by hand moulding are of two types : (a) Ground – moulded bricks and (b) Table – moulded bricks

(a) Ground – moulded bricks :

- The ground is first made level and fine sand is sprinkled over it.
- The mould is dipped in water and placed over the ground.
- The lump of tempered clay is taken and it is dashed in the mould.
- The clay is pressed or forced in the mould in such a way that it fills all the corners of mould.
- The extra or surplus clay is removed either by wooden strike or metal strike or frame with wire. A *strike* is a piece of wood or metal with a sharp edge and it is to be dipped in water every time.
- The mould is then lifted up and raw brick is left on the ground.
- The mould is dipped in water and it is placed just near the previous brick to prepare another brick. The process is repeated till the ground is covered with raw bricks.

Note :

1) The bricks prepared by dipping mould in water every time are known as the *slop – moulded bricks*.
2) The fine sand or ash may be sprinkled on the inside surface of mould instead of dipping mould in water, such bricks are known as the *sand – moulded bricks* and they have sharp and straight edges.
3) The lower faces of ground moulded bricks are rough and it is not possible to place frog(Is a mark of depth about 10 mm to 20 mm which is placed on raw brick during moulding) on such bricks. Frog serves two purposes : (1) It indicates the trade name of the manufacturer & (2) In brickwork, the bricks are laid with frog uppermost. It thus affords a key for mortar when the next brick is placed over it.

(b) Table – moulded Bricks :

- The process of moulding these bricks is just similar as above.
- But in this case, the moulder stands near a table of size about 2 m X 1 m.
- The clay, mould, water pots, stock board, strikes and pallet(Piece of thin wood) boards are placed on this table.
- The bricks are moulded on the table and sent for the further process of drying.
- However the efficiency of moulder decreases gradually because of standing at the same place for long duration.
- The cost of brick moulding also increases when table moulding is adopted.

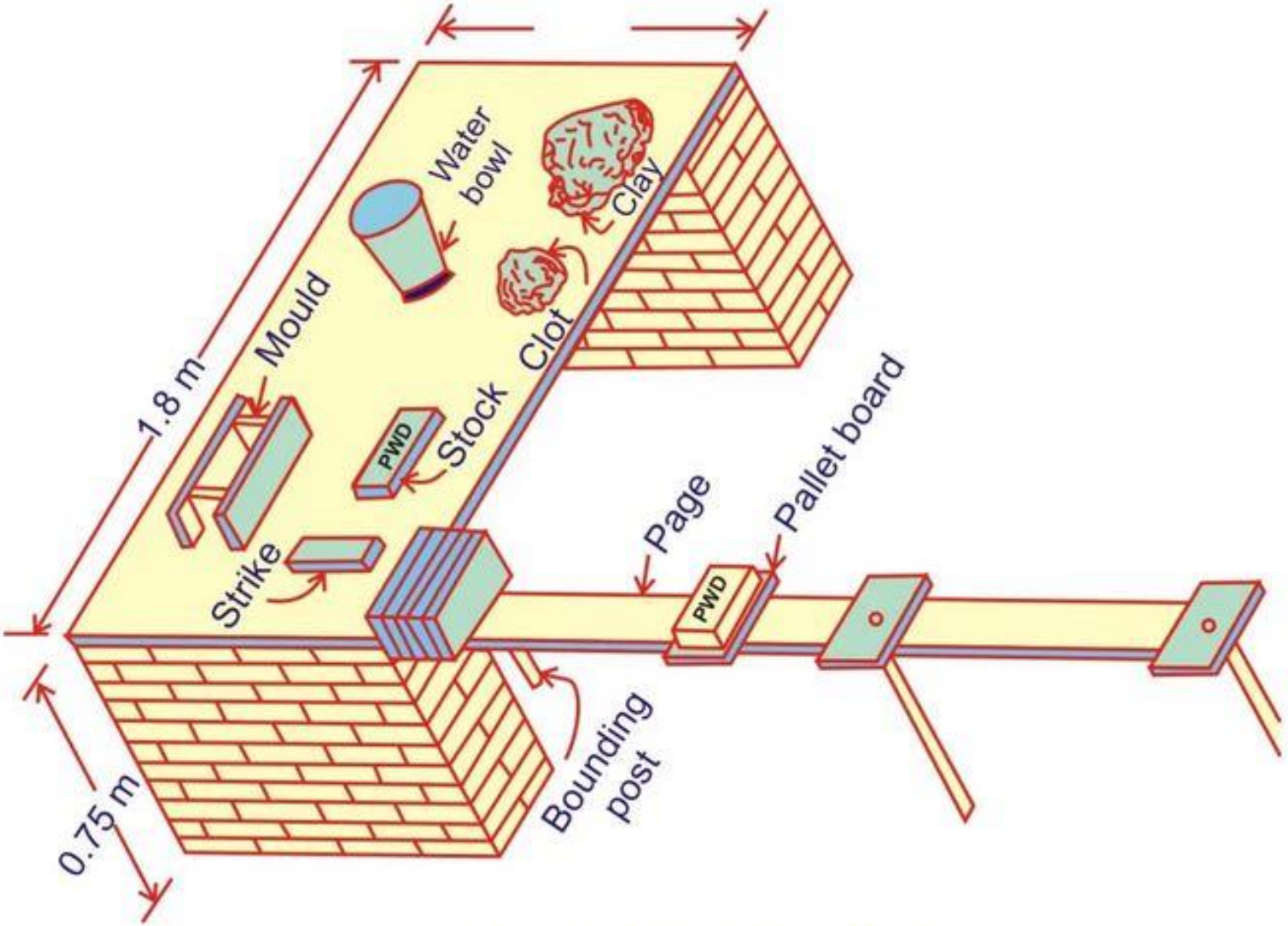


FIG. 2.5. Table Moulding of Bricks.

2. Machine moulding : The moulding may also be achieved by machines. It proves to be economical when bricks in huge quantity are to be manufactured at the same spot in a short time. It is helpful for moulding hard and strong clay. These machines are broadly classified in two categories :

(a) **Plastic Clay machines :** Such machines contain a rectangular opening of size equal to length and width of a brick. The pugged clay is placed in the machine and as it comes out through the opening, it is cut into strips by wires fixed in frames. The arrangement is made in such a way that strips of thickness equal to that of the brick are obtained. As the bricks are cut by wire, they are also known as the *wire cut bricks*.

(b) **Dry clay machines :** In these machines, the strong clay is first converted into powder form. A small quantity of water is then added to form a stiff plastic paste. Such paste is placed in mould and pressed by machine to form hard and well shaped bricks. These bricks are known as the *pressed bricks* and they do not practically require drying. They can be sent directly for the process of burning.

Note :

The wire cut and pressed bricks have regular shape, sharp edges and corners. They have smooth external surfaces. They are heavier and stronger than ordinary hand – moulded bricks. They carry distinct frogs and exhibit uniform dense texture.

DRYING :

- The damp bricks, if burnt, are likely to be cracked and distorted.
- Hence the moulded bricks are dried before they are taken for the next operation of burning.
- For drying, the bricks are laid longitudinally in stacks of width equal to two bricks.
- A stack consists of eight or ten tiers.
- The bricks are laid along and across the stock in alternate layers.
- All bricks are placed on edge.
- The bricks should be allowed to dry till they become leather hard or bone – dry with moisture content of about 2% or so.
- The important facts to be remembered in connection with the drying of bricks are as follows :

1) **Artificial Drying :** The bricks are generally dried by natural process.

- But when bricks are to be rapidly dried on a large scale, the artificial drying may be adopted.
- In such a case, the moulded bricks are allowed to pass through special dryers which are in the form of tunnels or hot channels or floors.
- Such dryers are heated with the help of special furnaces or by hot flue gases.
- The **tunnel dryer**s are more economical than **hot floor dryers** and they may be either periodic or continuous.
- In the former case, the bricks are filled, dried and emptied in rotation.
- In latter case, the loading of bricks is done at one end and they are taken out at the other end.
- The temperature is usually less than 120 degree C and the process of drying of bricks takes about 1 to 3 days depending upon the temperature maintained in the dryer, quality of clay product, etc.,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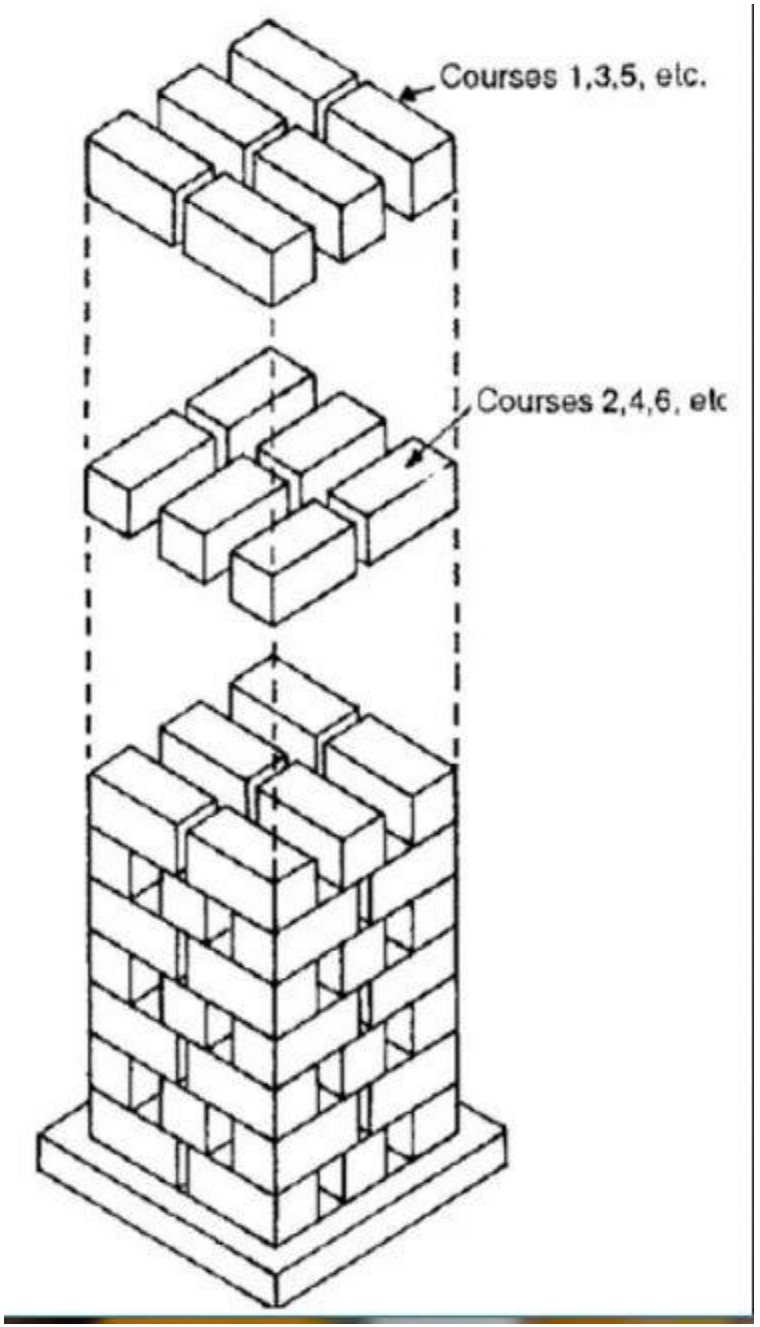
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2) Circulation of Air : The bricks in stacks should be arranged in such a way that sufficient air space is left between them for free circulation of air.

3) Drying yard : For the drying purpose, special drying yards should be prepared. It should be slightly on a higher level and it is desirable to cover it with sand. Such as arrangement would prevent the accumulation of rain water.

4) Period of drying : The time required by moulded bricks to dry depends on prevailing weather conditions. Usually it takes about 3 to 10 days for bricks to become dry.

5) Screens : It is to be seen that bricks are not directly exposed to the wind or sun for drying. Suitable screens, if necessary, may be provided to avoid such situations.

Burning :

- This is very important operation in the manufacture of bricks.
- It imparts hardness and strength to the bricks and makes them dense and durable.
- The bricks should be burnt properly.
- If bricks are over burnt, they will be brittle and hence break easily.
- It they are under burnt, they will be soft and hence cannot carry loads.
- When the temperature of dull red heat, about 650 degree C, is attained, the organic matter contained in the brick is oxidized and also the water of crystallization is driven away.
- But heating of bricks is done beyond this limit for the following purposes :

i. If bricks are cooled after attaining the temperature of about 650 degree C, the bricks formed will absorb moisture from the air and get rehydrated.

ii. The reactions between the mineral constituents of clay are achieved at higher temperature and these reactions are necessary to give new properties such as strength, hardness, less moisture absorption, etc., to the bricks.

- When the temperature of about 1100 degree C is reached, the particles of two important constituents of brick clay, namely, alumina and sand, bind themselves together resulting in the increase of strength and density of bricks.
- Further heating is not desirable and if the temperature is raised beyond 1100 degree C, a great amount of fusible glassy mass is formed and the bricks are said to be vitrified.
- The bricks begin to loose their shape beyond certain limit of vitrification.
- The burning of bricks is done either in clamps or in kilns.
- The clamps are temporary structure and they are adopted to manufacture bricks on a small scale to serve a local demand or a specific purpose.
- The kilns are permanent structures and they are adopted to manufacture bricks on a large scale.

Kiln

Vs

Clamp

COMPARISON BETWEEN CLAMP-BURNING AND KILN-BURNING

No.	Item	Clamp-burning	Kiln-burning
1.	Capacity	About 20000 to 100000 bricks can be prepared at a time.	Average 25000 bricks can be prepared per day.
2.	Cost of fuel	Low as grass, cow dung, litter, etc. may be used.	Generally high as coal dust is to be used.
3.	Initial cost	Very low as no structures are to be built.	More as permanent structures are to be constructed.
4.	Quality of bricks	The percentage of good quality bricks is small about 60% or so.	The percentage of good quality bricks is more about 90% or so.
5.	Regulation of fire	It is not possible to control or regulate fire during the process of burning.	The fire is under control throughout the process of burning.
6.	Skilled supervision	Not necessary throughout the process of burning.	The continuous skilled supervision is necessary.
7.	Structure	Temporary structure.	Permanent structure.
8.	Suitability	Suitable when bricks are to be manufactured on a small scale and when the demand of bricks is not continuous.	Suitable when bricks are to be manufactured on a large scale and when there is continuous demand of bricks.
9.	Time of burning and cooling	It requires about 2 to 6 months for burning and cooling of bricks.	Actual time for burning of one chamber is about 24 hours and only about 12 days are required for cooling of bricks.
10.	Wastage of heat	There is considerable wastage of heat from top and sides and hot flue gas is not properly utilized.	The hot flue gas is used to dry and pre-heat raw bricks. Hence the wastage of heat is the least.

Selection of Bricks

1. Decide On The Colour

2. Select Your Type Of Brick

Today different types of bricks are used in construction based on the raw material used in it like concrete, lime, fly ash and many more.

3. Brick size

Another very important element of selecting bricks is its size. The size of the bricks has a huge impact on many other elements of a project, things like how the building is designed, its overall aesthetic appearance, the ease of laying the bricks, etc.

4. Texture

Just like colour you also have a wide range of options when it comes to the texture of the building bricks. These days bricks are available in a variety of textures – smooth, light textured, heavy textured, tumbled and stock.

5. Mortar Impacts The Colour

Another key feature for determining the overall appearance of a building is mortar colour. This is because mortar accounts for 15 percent to 17 percent of the visible brickwork of a wall depending on the bond pattern.

6. Orientation

The orientation in which the bricks are laid will have a big impact on the overall look of the project. With orientation, we mean defining which side of the brick is outward facing and which is fixed to the existing structure.

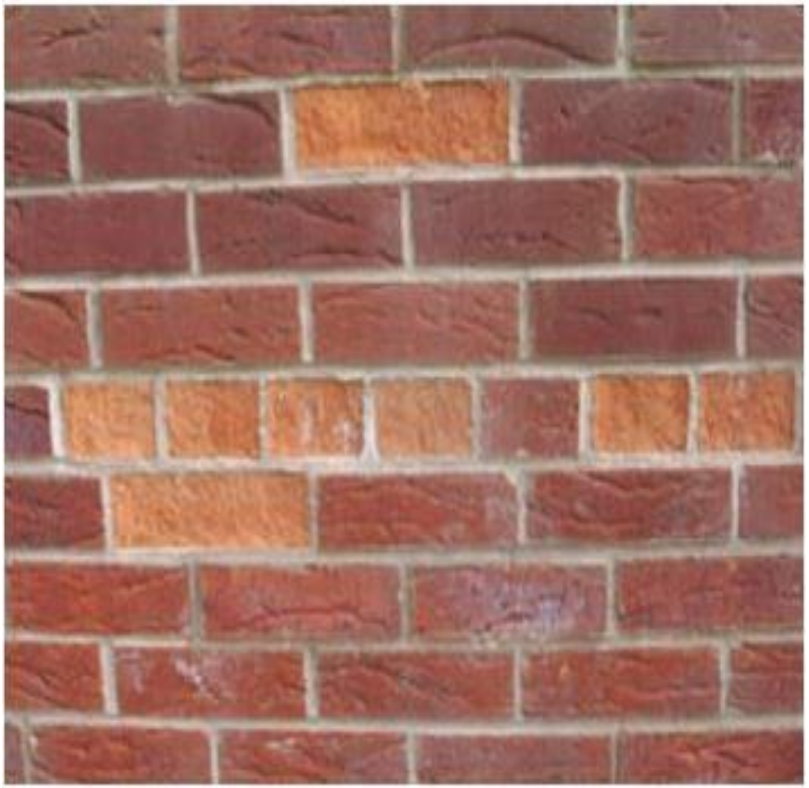
7. Select A Bond Pattern

Patterns – another key consideration in selecting the bricks. While the primary purpose of a bond is to ensure the brickwork is strong and stable

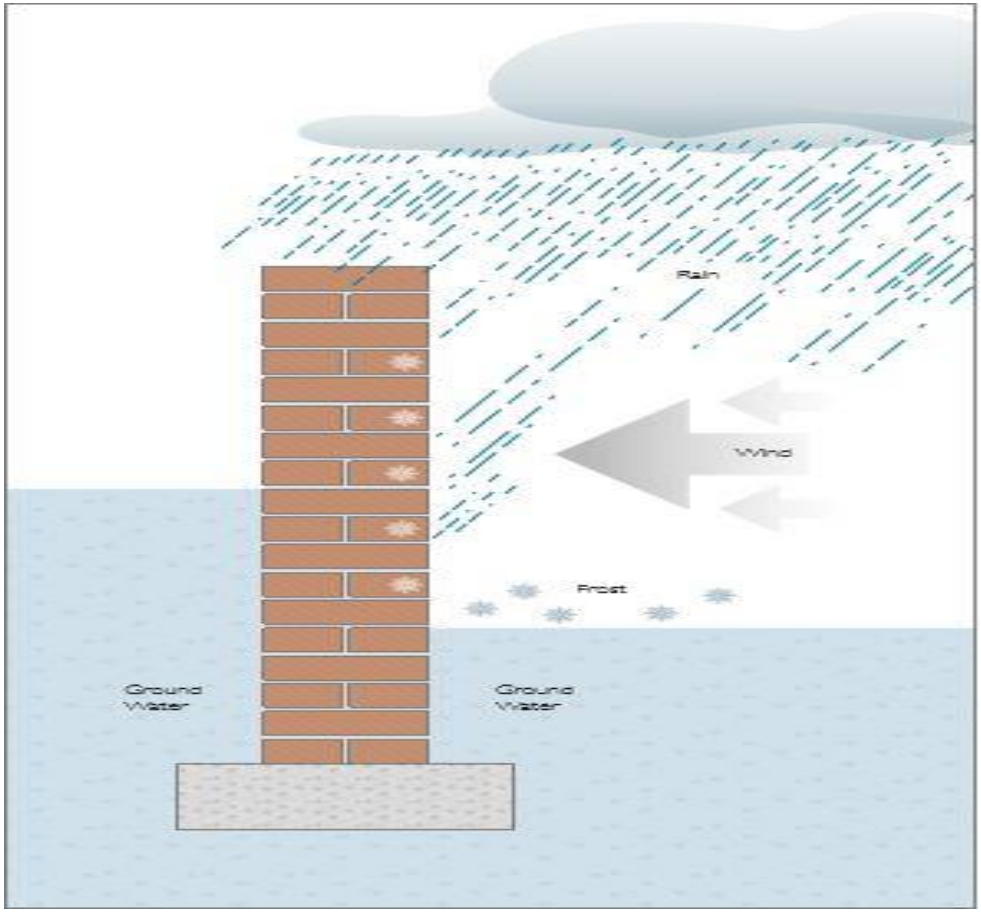
DURABILITY ASPECTS OF BRICKS

- The inherent durability of masonry is evident by the number of 16th century buildings and structures still standing or being used today.
- Their longevity is related to their design and workmanship and materials chosen for the local conditions.
- Three of the potentially destructive agents affecting masonry are;
  - Water
  - Frost
  - Temperature Change
- Brickwork absorbs water falling as wind driven rain washing over the surface. Some areas will absorb more water than others, notably horizontal and inclined surfaces and parts in contact with the soil, and these may be potentially at risk from frost attack.
- **FROST ATTACK :** The repeated action of rain - water freezing and subsequently thawing in saturated brickwork can cause spalling of the brick surface.

- **<u>SULPHATE ATTACK :</u>** In saturated brickwork soluble salts from certain types of bricks or surrounding materials may cause a chemical reaction with a constituent of the Portland cement in the mortar. The surface of the mortar joint will crack, and the inside will crumble and expand, disrupting the brickwork.



Frost attack



- **Moisture :** Moisture in all its forms—snow and ice, wind-driven rain, water vapour— greatly affect the performance of building materials. When water enters brick, thermal expansion can cause the surface to peel, pop out, or flake off. This phenomenon, commonly known as **spalling**, is caused by excess moisture in the masonry that exerts pressure outward. It can also lead to disintegration of insulation and the staining of interior finishes.
- **Temperature change :** The compressive strength of the brick increases with increase in firing temperature but Water Absorption and Saturation Coefficient of the fired clay bricks decreased with the increase in the firing temperature.

6.19. TOOLS FOR BRICK LAYING

The following tools are used in brick masonry construction.

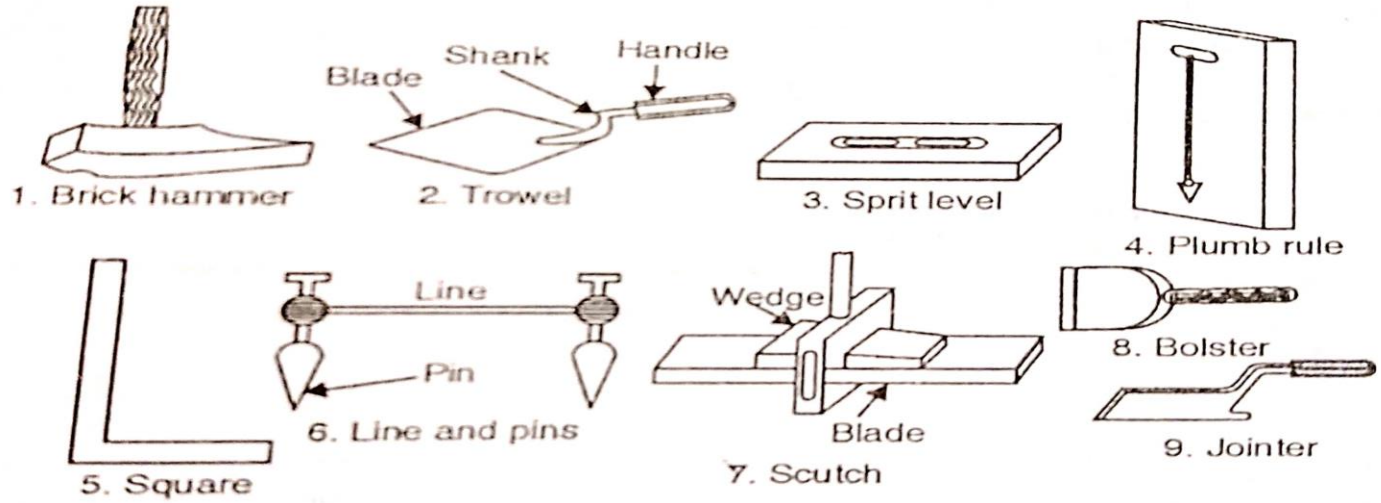
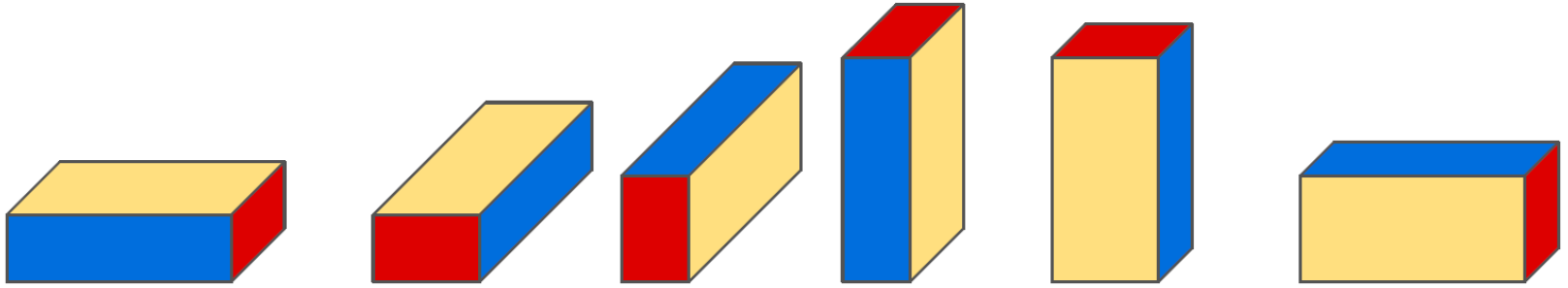
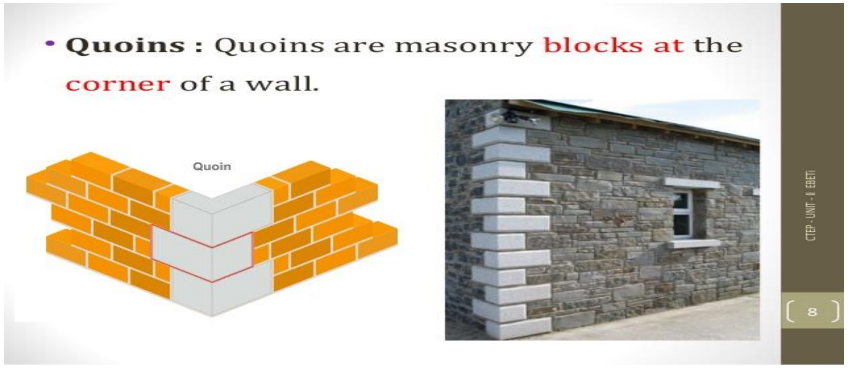
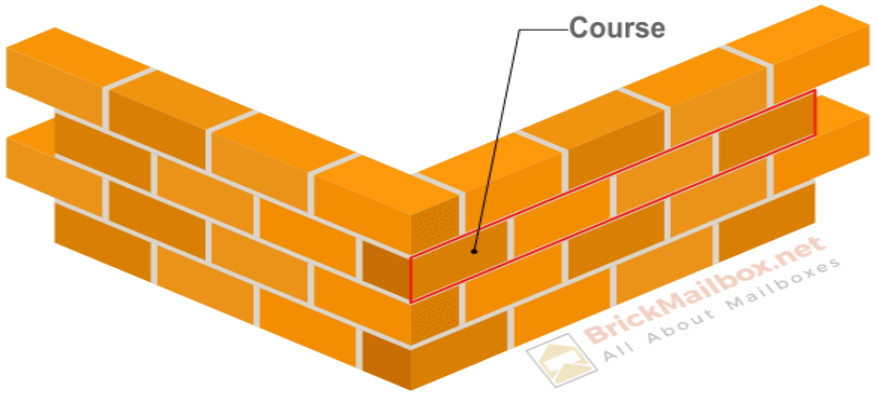


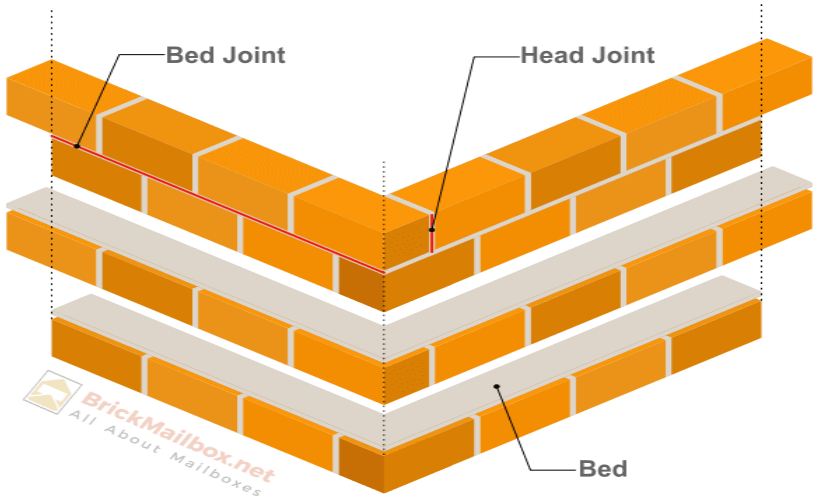
FIG. 6.33. BRICK LAYING TOOLS.

1. *Brick hammer* : Used for cutting bricks; also for pushing the bricks in courses.
2. *Trowel* : Used for lifting and spreading mortar ; also for cutting bricks.
3. *Spirit level* : Used, with straight edge, for getting horizontal surface ; also used for levelling.
4. *Plumb rule* : Used for checking verticality of brick walls.
5. *Mason's square* : Used for checking right angles.
6. *Line and pins* : Used for maintaining alignment of courses.
7. *Scutch* : Used for cutting soft bricks and dressing out surfaces.
8. *Bolster* : Used for accurate cutting of bricks.
9. *Jointer* : Used for pointing the joints.









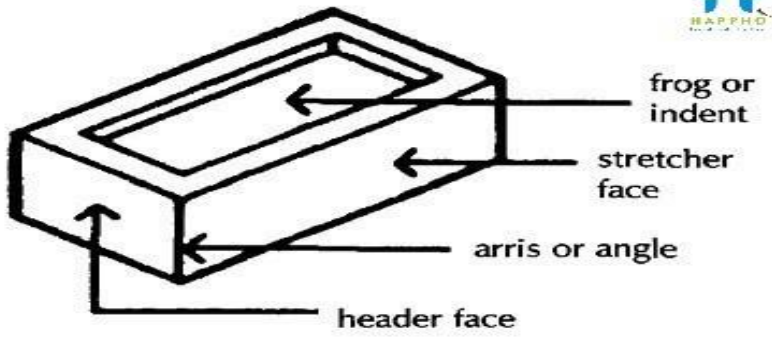


Fig. 51 Brick faces.

BRICK LAYING

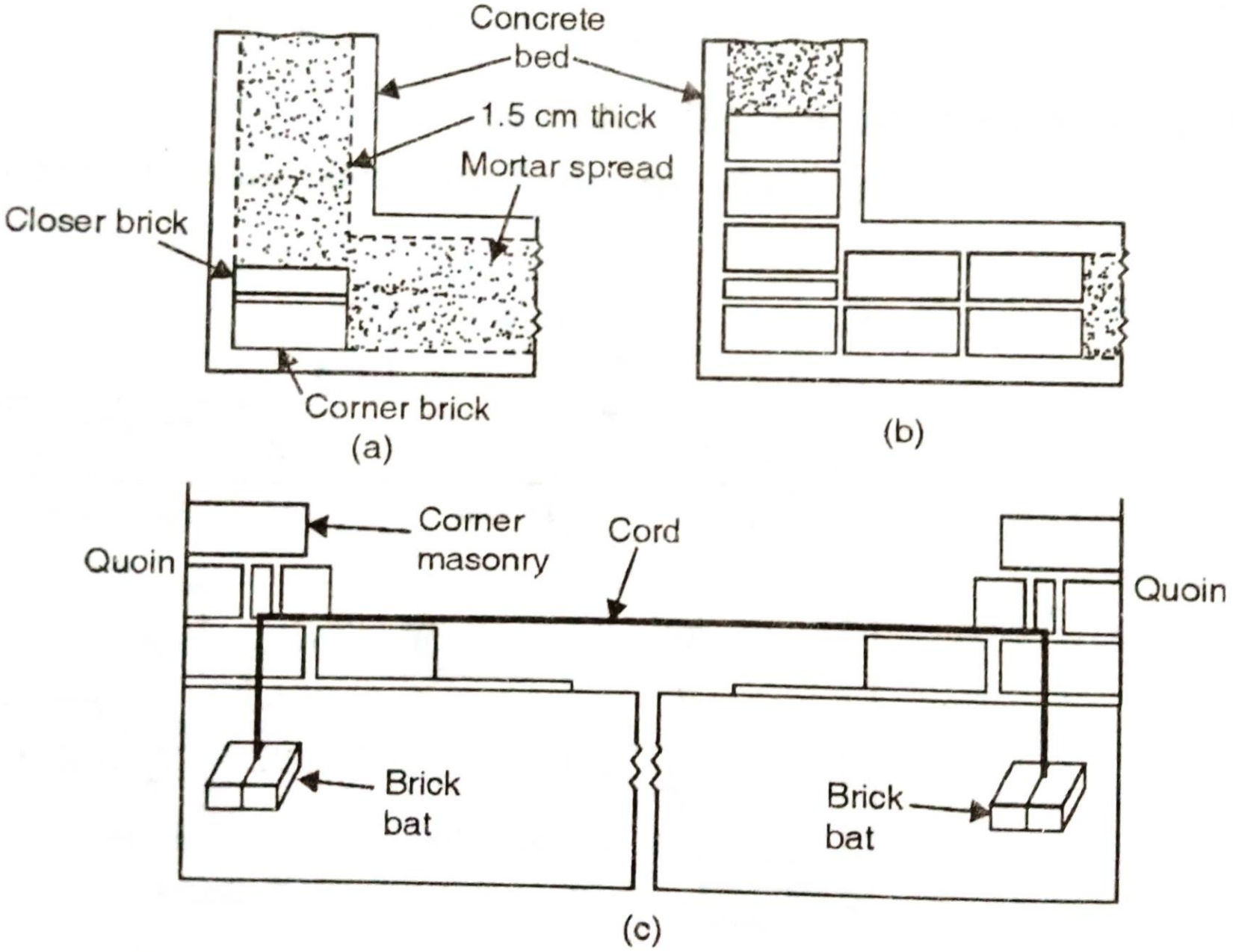
- Brick masonry construction is a great art since laying must be systematically done with respect to bonding, jointing and finishing. Bricks laying for wall construction is done in the following steps :

1) All the bricks to be used in construction are thoroughly soaked in water so that they do not absorb the water of the mortar.
2) Mortar is spread on the top of the foundations course, over an area to be covered by the edges of the wall. The depth of spread of mortar may be about 1.5 cm.
3) The corner of the wall is constructed first. For that, one brick is laid first at the corner and pressed with hand so that the thickness of bed – joint remains only about 1 cm. The first closer is covered with mortar on its side and then presses against the first corner brick, such that 1 cm thick vertical joint is obtained. The excess mortar from the sides will squeeze out, which is cleaned off with trowel.

4) The level and the alignment is checked. If the brick or closer is not in level, they are pressed gently further. Similarly, the placement of the edges of the bricks is checked so that correct offset of concrete is available.

5) Few headers and stretchers are then laid in the first course, adopting the same method as described in step 3 for the closer brick. That is, mortar is applied on the side of the brick to be laid and it is pressed against the previous brick laid earlier, so that excess mortar squeezes out from the sides. The level and alignment of these are properly checked.

6) After having laid the first course at the corner, mortar is laid and spread over the first course, to a depth of about 1.5 cm and end stretcher is laid first, by pressing it into the mortar and then hammering, it slightly so that the thickness of bed – joint is 1 cm. Mortar is then applied on the side of another stretcher and pressed to the side of the corner stretcher so that thickness of vertical joint is about 1 cm. Excess mortar which oozes out is cleaned off. This way, stretchers and headers are laid for the second course.


Concrete
bed
1.5 cm thick
Mortar spread
Closer brick
Corner brick
(a)
(b)
Quoin
Corner
masonry
Cord
Quoin
Brick
bat
Brick
bat
(c)

7) Other courses(usually 4 to 6) are then laid at the corner. Similarly, the corner at the other end of the wall is laid. Since the corner construction at each end works as a guide for filling in – between bricks of various courses, the corner construction should be done with great care. The plumb as well as alignment should be thoroughly checked. Plumbing up by means of plumb rule should be frequently restored to as new brick work has a tendency to overhang. Vertical face is obtained by tapping the handle of the trowel against the over hanging bricks.

8) For building the in – between portion of the wall a cord is stretched along the top of the first course laid at each corner. A brick bat is attached at either end of the cord so that it remains tout. The course is then built. The line or cord is then shifted up, corresponding to the top level of the second course, and the second course is also constructed. The procedure is repeated till the in – between wall is constructed to the height of corner masonry.

9) The corners of the wall are then raised further, and steps 7 and 8 are repeated. All the walls should be uniformly constructed so that the load on the foundations is uniform. It should be ensured that the difference in height between two adjoining walls is not more than 1m.

10) Perpends must be kept vertical. This should be checked, as the work proceeds, with the help of straight edge and the square. The straight edge is placed flat on the course and slightly projecting beyond the face. The stock of the square is then set against the underside of the straight edge with the blade coinciding with the last – formed vertical joint.

11) Bricks with one frog should be laid with its frog on its top face to ensure that they will be completely filled with mortar.

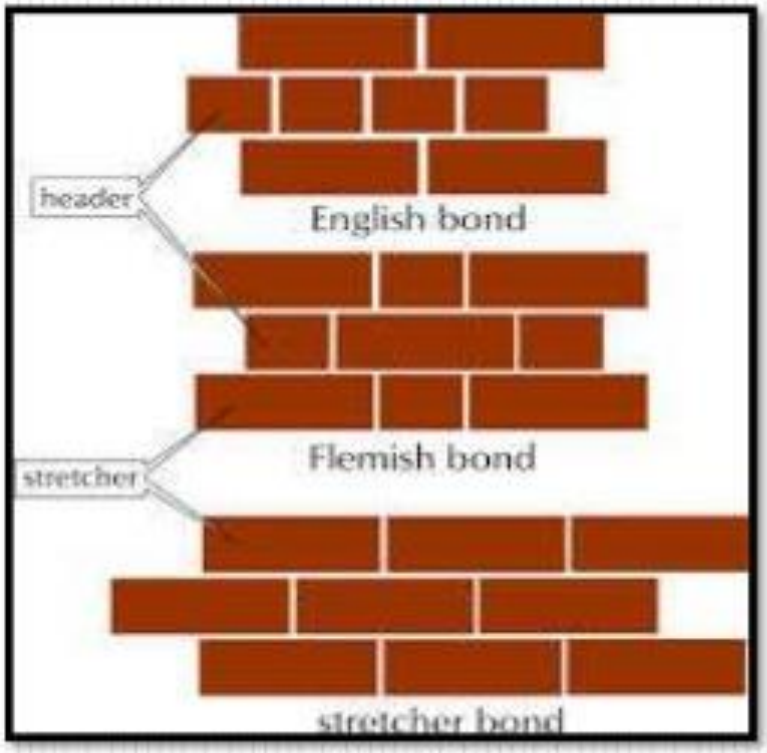
12) In the case of thick walls, mortar is first spread over the entire bed and the outer bricks are laid as described above. The inner bricks are then pressed and rubbed into position to cause some of the mortar to rise between the vertical joints, which are finally filled flush with liquid mortar so that no hollow spaces are left.

13) All loose materials, dirt and set lumps of mortar which may be lying over the surface on which the brick work is to be freshly started, should be removed with wire brush and wetted slightly.

14) After having constructed the wall, joining and pointing is done. The procedure for jointing and pointing has been described separately. However, all the joints should be cleaned and finished after every day's work.

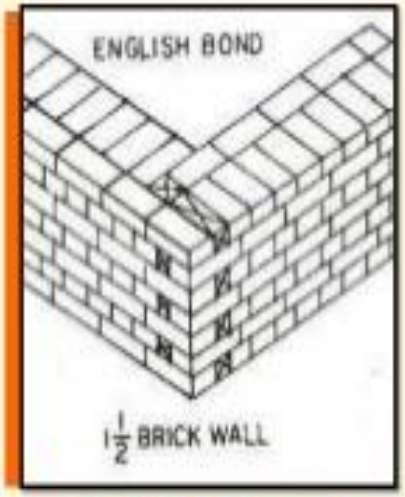
BONDS IN BRICK-WORK

1. English bond.
2. Flemish bond.
3. Header bond.
4. Stretcher bond.
5. Facing bond.
6. English cross bond.
7. Brick on edge bond.
8. Dutch bond.
9. Raking bond.
10. Garden wall bond



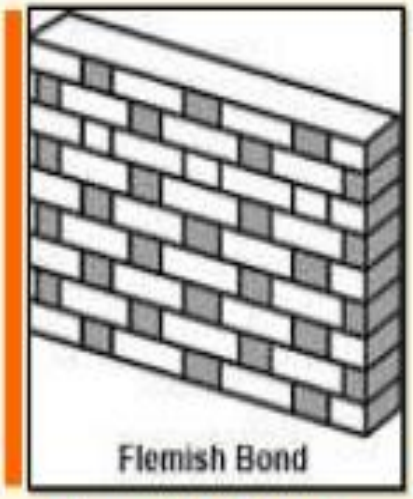
TYPES OF BRICK BOND

BRICK BOND



English Bond

The bond having headers and stretchers laid in alternate courses is called English bond. It is commonly adopted for brickwork of buildings where strength is of prime importance.

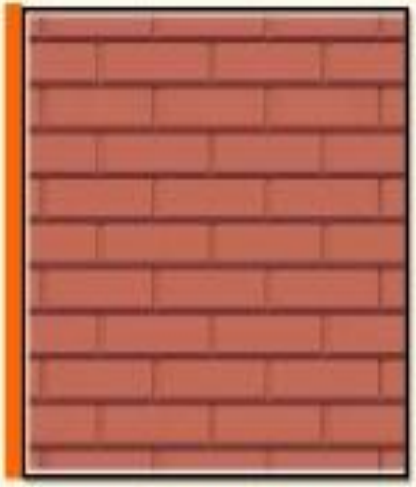


Flemish Bond

bond having headers and stretchers laid alternately in the same course is called Flemish bond. It is commonly used in the buildings where the external appearance is of prime importance

Heading Bond

The bond having all the bricks laid as headers in every course of a wall is called heading bond or header bond. It is commonly used for constructing staining (brickwork) of wells, footings, corbels, cornices, etc.

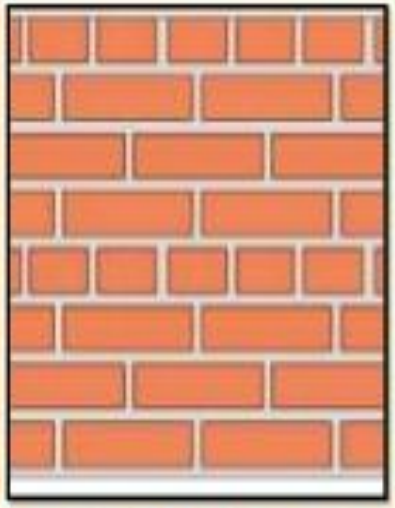


Stretching Bond

The bond having all the bricks laid as stretchers in every course is called stretching bond. It is used for constructing 10cm. thick brick partition walls

TYPES OF BRICK BOND

BRICK BONDING

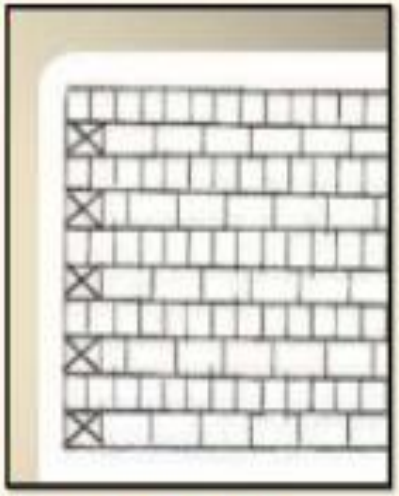


Garden Wall Bond

The bond used for constructing compound walls of a garden is called garden wall bond. It is used for constructing thick garden walls, boundary walls, compound walls, etc. it is also used for constructing cavity walls.

Facing Bond

The bond having bricks of different thickness and qualities, used for facing and backing of the wall, is called facing bond

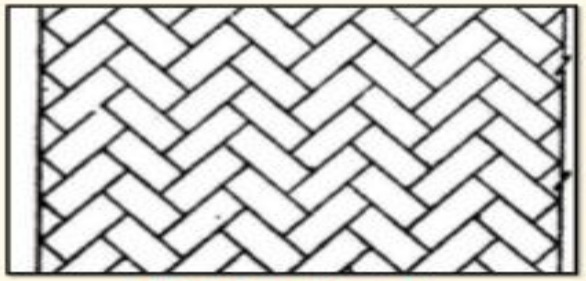


Dutch Bond

The bond having headers and stretchers laid in the alternate courses and every stretching course started with ¼ brick-bat is known as Dutch bond. It is not in common use.

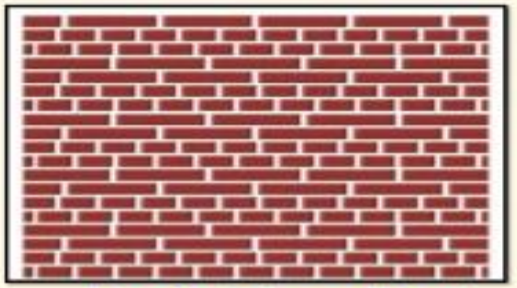
TYPES OF BRICK BONDING

BRICK BONDING



Raking Bond

The bond having all the bricks laid at an angle to the facing and backing of a wall is called raking bond. It is used for architectural finish and for the footings of high walls.

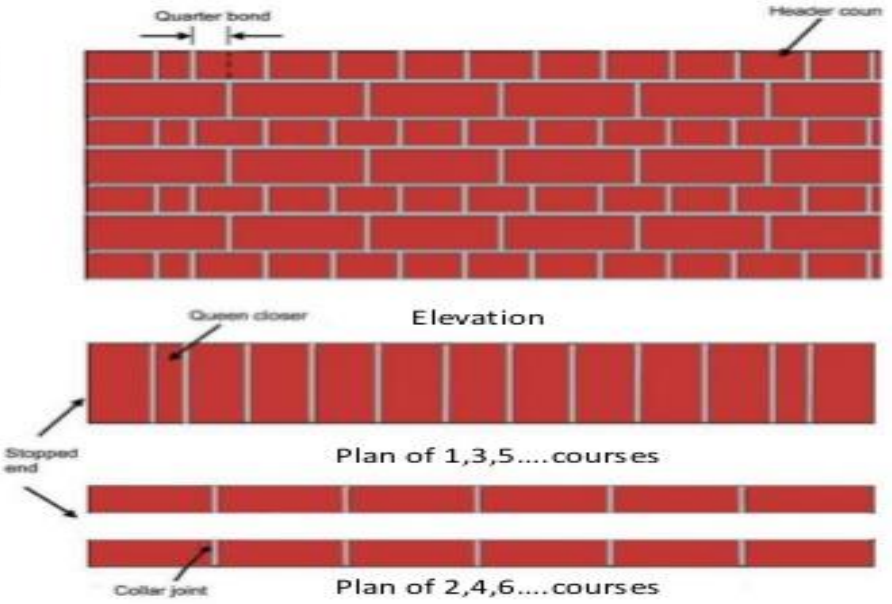


English Cross Bond

The bond having headers and stretchers laid in alternate courses, and a header provided after the quoin stretcher, in every alternate stretching course is called English cross bond. It is not used now-a-days.

7. Brick on Edge Bond (Silverlock's Bond or Soldier's course)

- This bond is inspired by English bond but in this bond the stretcher courses are replaced by laying the brick on edges and header courses laid on the beds.
- Queen closer is provided after quoin header in the header course.
- This type of bond is weak in strength but economical so usually used as garden walls, compound walls etc.



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THANK YOU