1.3 Tests on bricks – Compressive strength – Water Absorption – Efflorescence

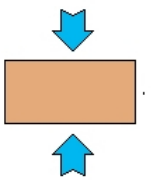
Various types of tests on bricks are conducted to check the qualities of bricks for construction purposes. Tests on bricks are conducted at construction site as well as in laboratory. Bricks are oldest and important construction materials because of their durability, reliability, strength and low cost. To produce good quality of structure, good quality materials are required. To decide the quality of the materials some tests are to be conducted on bricks. The tests which are required to find the suitability of bricks for construction purposes are discussed below.

Following tests are conducted on bricks to determine its suitability for construction work.

1. Absorption test
2. Crushing strength test
3. Hardness test
4. Shape and size
5. Color test
6. Soundness test
7. Structure of brick
8. Presence of soluble salts (Efflorescence Test)

Compressive strength – Water Absorption – Efflorescence

Crushing strength (Compressive strength) of bricks is determined by placing brick in compression testing machine. After placing the brick in compression testing machine, apply load on it until brick breaks. Note down the value of failure load and find out the crushing strength value of brick. Minimum crushing strength of brick is 3.50N/mm^2.if it is less than 3.50 N/mm^2, then it is not useful for construction purpose.

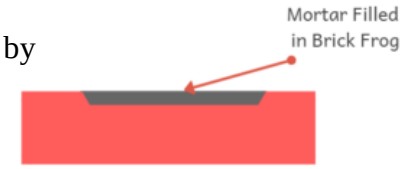


Compression force is the Force that squeezes material together
or
Pushing Force applied on two faces of the specimen

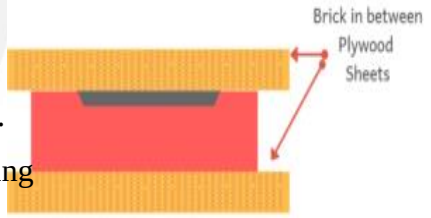
Compression Strength on Brick

Procedure:

1. Three bricks are picked from the brick pouch and the unevenness on the brick faces are removed by grinding.
2. Immerse the brick samples in the water for 24 hours at the temperature of 23^0c
3. Prepare the mortar by mixing the cement and sand at the ratio of 1:1.
4. Fill the frog with the mortar paste and allow to set the bricks in jute bags for the period of 24hrs.
5. Also, check for the voids on the brick surface. If there any fill the voids by flushing the mortar on them.



6. Take out the bricks from bags and immerse them back in the water for 7 days to complete the hardening of mortar on brick.
7. Allow the bricks to dry, before placing it on the compressive testing machine
8. Place the specimen flat-wise on the base of CTM, with mortar filled face upwards between the two flat plywood sheets. Plywood sheets are used to hold the brick in the correct position while testing.
9. Start the CTM and apply the load axially on the specimen at the rate of **14 N/mm^2 (140 kg/cm^2) per minute** till the brick starts breaking. Repeat the same procedure with the leftover bricks, Note down the reading of each brick from CTM once the brick starts tearing



Formula to calculate the Compressive strength:

Compressive Strength = Max load at which Specimen starts breaking (N) / Contact area (mm^2)

The Standard size of brick is 190mm x 90mm x 90mm

Area = Length x width = 190×90 = 17,100Sq.mm

Suppose the max load at which the Brick starts cracking = 600KN

As per formulae,

Compressive strength of calculated bricks = 600×100 / 17100 = 35N/mm^2

The same procedure is adopted and the average value is calculated.

Water Absorption test on Bricks

Absorption test is conducted on brick to find out the amount of moisture content absorbed by brick under extreme conditions. In this test, sample dry bricks are taken and weighed. After weighing these bricks are placed in water with full immersing for a period of 24 hours. Then weigh the wet brick and note down its value. The difference between dry and wet brick weights will give the amount of water absorption. For a good quality brick, the amount of water absorption should not exceed 20% of weight of dry brick.

Testing Method

- 20 bricks are taken randomly from a stack.
- The bricks are put in an oven at a temperature of 1050 C for drying.
- Bricks are weighed in a digital weighing machine and is record asW1
- The bricks are immersed in water at room temperature for 24 hours.
- After 24 hours' immersion, the bricks are taken out of water and wiped with a damp cloth for 3 minutes.
- The bricks are weight again and recorded as W2.
- Calculate water absorption of brick in percentage $= \frac{W2-W1}{W1} \times 100$

Water absorption Value for different bricks

Brick Class	**The maximum water absorption Percentage**
First	20%
Second	22%
Third	25%
Heavy duty machine made	5%

Presence of soluble salts (Efflorescence Test)

A good quality brick should be free of soluble salts. However, if soluble salts are present, they form a white substance on the brick surface. Generally, efflorescence on brick is the name given to this white formation. The test procedure for performing the Efflorescence test on brick is as follows.

- First, take a brick specimen and submerge it in water for 24 hours.
- After 24 hours, drain the brick and allow them to dry.
- Keenly observe the brick surface.

Brick surface condition	**Degree of Efflorescence**
No white substance	Zero efflorescence
10% white substance	Slight efflorescence
50% white substance	Moderate efflorescence
More than 50% white substance	Heavy efflorescence

Hardness test on bricks

The hardness test on bricks is a field verification test. Hence they are performed on-site. A good brick should resist scratches against sharp things. The following is the test procedure for the hardness test on bricks.

- At first, choose a brick randomly from the stack.
- Using a nail or finger make a mark on its surface.
- If there is no scratch, then it is a good quality brick.

Shape and size Testing of Bricks

A good quality brick should be uniform in size and rectangular in shape. In order to check this, measure the brick on the field. The standard size of the brick is 190mm x 90mm x 90mm.

Randomly, choose 20 bricks from the stack.

Sort them in length, width and height wise.

If the sizes are the same, then they are good bricks.

Colour test of bricks

Normally good quality bricks are deep red or copper colour. The colour test is a field test. Therefore, it can be observed visually.

Structure Test on Bricks

Homogeneity and compact structure are the quality of good bricks.

- Randomly, pick one brick from the stack.
- Cut the brick into two pieces at the center.
- Then observe its inner side.
- They should be free from defects such as lumps, holes etc.

Soundness test of bricks

The soundness test of bricks is a field test used to determine the strength of the bricks.

- In this test, choose two bricks randomly without damage or break.
- Hit the bricks with each other.
- Then, listen to the sound the brick produce.
- If a metal ringing sound is produced, then it is good quality bricks.