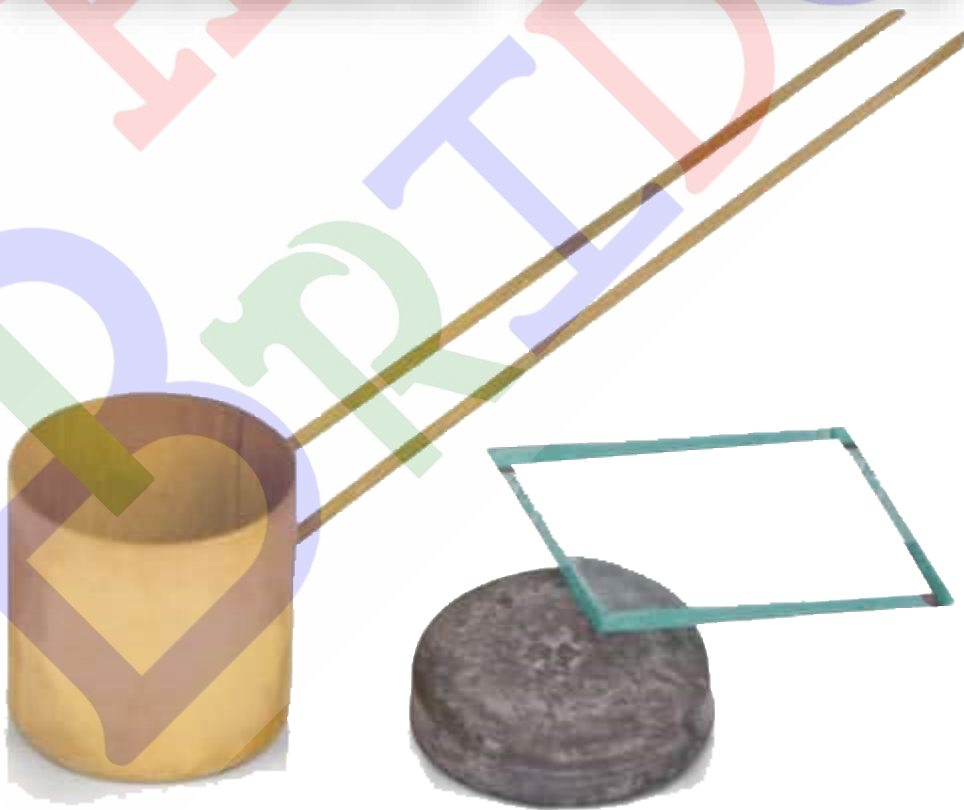


LABORATORY TESTS

FOR ORDINARY

PORTLAND CEMENT



RECOMMENDED PRACTICE FOR STORAGE AND TESTING OF CEMENT

LABORATORY TESTS FOR ORDINARY PORTLAND CEMENT

SR. NO.	LABORATORY TEST	RELEVANT I.S. CODE (LATEST EDITION)	REQUIREMENT
1	FINENESS	For OPC 53 grade IS 12269 (Reaffirmed 1999). For OPC 43 grade IS 8112-1989	Specific surface of cement Shall not be less than 225 sq.m./ kg for OPC 53 grade and OPC 43 grade cements
2	SETTING TIME Initial Setting Final Setting	IS4031-1968 (53 Gr.) IS4031 Part-5 1988 (43Gr)	Not less than 30 minutes Not more than 600 minutes For Each Lot or Once in a Month, whichever is earlier.
3	Compressive Strength	IS4031-1968 (53 Gr.) IS4031 Part-6 1988 (43Gr) IS4031 Part-6 1988 (43Gr)	Not less than, for 72± 1 hr -27MPa 168 ± 2hrs-37 MPa 672 ± 4hrs -53 MPa Not less than, for 72± 1 hr -23MPa 168 ± 2hrs-33 MPa 672 ± 4hrs -43 MPa
4	SOUNDNESS OPC 53 Grade. i) By Le chateliers Method ii)By Le chateliers Method (Autoclave) OPC 43 Grade. i)By Le chateliers Method ii)By Le chateliers Method (Autoclave)	IS 4031-1968 IS 4031-1968 IS 4031- Part 3 -1988 IS 4031- Part 3 -1988	Expansion shall not be more than 10mm. Expansion shall not be more than 0.8 percent. Expansion shall not be more than 10mm. Expansion shall not be more than 0.8 percent.

FINENESS OF CEMENT

Fineness of cement should be tested at site with the help of 90 μ sieve.

After sieving the maximum retained quantity should be $\leq 10\%$.

Fineness Test of Cement



FINENESS BY BLAINE AIR PERMEABILITY



The Blaine Air Permeability Apparatus determines the fineness of Portland cement in terms of specific surface area expressed as the total surface area in square centimeters per gram of mortar or cement. The Blaine works by drawing a definite quantity of air through of bed of cement exhibiting a definitive porosity value. The number and size of the pores in a prepared bed of definite porosity is a function of the size of the particles and determines the rate of airflow through the bed. This procedure is outlined in IS 5516.

The Humboldt Blaine Air Permeability Apparatus consists of: calibrated U-tube manometer, ground glass joint, stainless steel test cell and plunger, rubber aspirator bulb and perforated disc. Includes an 8 oz (226.8g) bottle of red manometer fluid, filter paper, wood block for holding test cell during filling and a funnel. Mounted on finished wood panel with rubber-footed base.

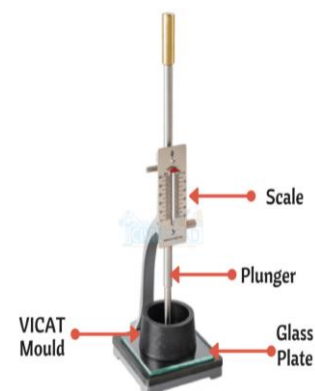
Fineness by Blaine air permeability apparatus should be $\geq 225 \text{ m}^2/\text{Kg}$.

NORMAL CONSISTENCY OF CEMENT

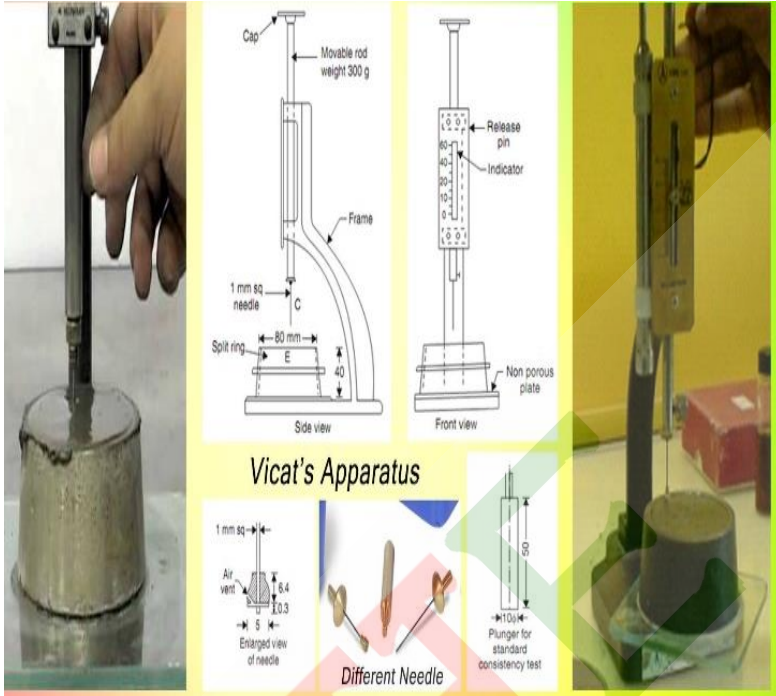
The Standard or Normal consistency for Ordinary Portland cement varies between 25-35%.

To prepare a mix of cement paste of Standard consistency 25-35% of water is added to cement.

For finding the normal consistency of cement as per **IS:4031-PART4-1988 VICAT APPARATUS** test is performed.



INITIAL & FINAL SETTING TIME



Setting time of cement test performed with the help of **VICAT APPARATUS** as per **IS 4031 Part-5 1988**.

The initial setting time of OPC & PPC should be greater than 30 mints and final setting time should be less than 600 mints.

Water content for initial & final setting time should be 85% of normal consistency.

SOUNDNESS TEST OF CEMENT

The maximum limit of soundness by Le Chatelier apparatus should be 10%.

The soundness value of cement should be maximum 0.8 % by autoclave method.

This test performed as per **IS 4031-1988** Part-3.

Water content for soundness test should be 78% of Normal consistency value.



COMPRESSIVE STRENGTH OF CEMENT

Compressive Strength of Cement is the capacity of taking compressive loads of cement.

It is determined by compressive strength test on mortar cubes compacted by means of a standard vibration machine. Standard sand (IS:650) is used for the preparation of cement mortar. The specimen is in the form of cubes $70.6\text{mm} \times 70.6\text{mm} \times 70.6\text{mm}$.

APPARATUS: -

Vibration Machine



Cube Mould



PROCEDURE: -

- Environmental condition for cement testing should be of temperature $27 \pm 2^\circ \text{C}$.
- Take 200 g of cement and 600 g of standard sand and mix them dry thoroughly.
- Add $(P/4+3) \times 8$ [P is % of water required for preparing paste of standard consistency] to the dry mix of cement and sand and for a time of 3 to 4 minutes mix them properly is that they form a mix of uniform colour. If the mix is not homogeneous after 4 minutes reject the mix and do the procedure again.

Measuring Cylinder & Balance



Compression Testing Machine



- After 24 hrs. remove the cube from the mould and immediately submerge in fresh clean water in temperature-controlled cube curing tank where its temp. is kept in $27\pm 2^{\circ}\text{C}$. They should be submerged in water till testing.
- Prepare at least 9 cubes in the manner explained.
- Place the test cube on the platform of a compressive testing machine so that the cubes central line and central line of platform coincides. No packing materials to be used between the cubes and loading plates.
- At the rate of $140\text{kg}/\text{cm}^2/\text{minute}$ apply the load steadily and uniformly.
- 3 Cubes to be tested on completion of 3, 7 and 28 days of testing and to be reported as shown below.

CALCULATIONS: -

Compressive Strength = P/A

[P = Maximum load applied to the cube. (N)

A = Cross sectional area (Calculated from the mean dimensions) (mm^2)]

- Compressive strength is reported to the nearest $0.5\text{ N}/\text{mm}^2$
- Specimen that give strengths differing by more than 15% from the average value of all the test specimen should not be considered.
- Test three cubes for compressive strength for each period of curing.

• Clean the cube moulds of cement thoroughly and place them the vibrating machine. It should be hold properly in position by clamps provided on the machine.

• Fill the mould with entire quantity of mortar using a suitable hopper attached to the top of the mould for facility of filling and vibrate it for 2 minutes

• at a specified speed of 12000 ± 400 per minute to achieve full compaction.

• Remove the mould from the machine and keep it in a place with temp of $27\pm 2^{\circ}\text{C}$ and relative humidity of 90% for 24 hours.

REPORTING OF RESULTS: -

Test result of Cement Cube Testing is reported as following.

SL No	Date of Casting	Date of Testing	Age (Days)	Weight (gm)	LOAD (KN)	Strength (Mpa)	AVG Strength (Mpa)	Signature of Relevant Authorities	Remarks
1	14/08/2018	17/08/2018	3	854	182	36.51	35.98		
				851	179	35.91			
				855	177	35.51			
2	14/08/2018	21/08/2018	7	845	209	41.93	43.00		
				851	215	43.13			
				843	219	43.94			
3	14/08/2018	11/09/2018	28	855	256	51.36	51.76		
				862	267	53.57			
				860	251	50.36			