**Test to Check Fineness of Cement**

**FINENESS**
so we need to determine the fineness of cement by dry sieving as per IS: 4031 (Part 1) – 1996. The principle of this is that we determine the proportion of cement whose grain size is larger than specified mesh size.
The apparatus used are 90µm IS Sieve, Balance capable of weighing 10g to the nearest 10mg, A nylon or pure bristle brush, preferably with 25 to 40mm, bristle, for cleaning the sieve.
Sieve shown in picture below is not the actual 90µm sieve. It’s just for reference.

![Sieve Image]

**Procedure to determine fineness of cement**
i) Weigh approximately 10g of cement to the nearest 0.01g and place it on the sieve.
ii) Agitate the sieve by swirling, planetary and linear movements, until no more fine material passes through it.
iii) Weigh the residue and express its mass as a percentage $R_1$, of the quantity first placed on the sieve to the nearest 0.1 percent.
iv) Gently brush all the fine material off the base of the sieve.
v) Repeat the whole procedure using a fresh 10g sample to obtain $R_2$. Then calculate $R$ as the mean of $R_1$ and $R_2$ as a percentage, expressed to the nearest 0.1 percent. When the results differ by more than 1 percent absolute, carry out a third sieving and calculate the mean of the three values.

**Reporting of Results**
Report the value of $R$, to the nearest 0.1 percent, as the residue on the 90µm sieve.
Test to Check Soundness of Cement

**SOUNDNESS**

Soundness of cement is determined by Le-Chatelier method as per IS: 4031 (Part 3) – 1988.

Apparatus – The apparatus for conducting the Le-Chatelier test should conform to IS: 5514 – 1969

Balance, whose permissible variation at a load of 1000g should be +1.0g and Water bath.

![Le-Chatelier apparatus](image)

*Le-Chatelier apparatus*

**Procedure to determine soundness of cement**

i) Place the mould on a glass sheet and fill it with the cement paste formed by gauging cement with 0.78 times the water required to give a paste of standard consistency.

ii) Cover the mould with another piece of glass sheet, place a small weight on this covering glass sheet and immediately submerge the whole assembly in water at a temperature of 27 ± 2°C and keep it there for 24hrs.

iii) Measure the distance separating the indicator points to the nearest 0.5mm (say $d_1$).

iv) Submerge the mould again in water at the temperature prescribed above. Bring the water to boiling point in 25 to 30 minutes and keep it boiling for 3hrs.

v) Remove the mould from the water, allow it to cool and measure the distance between the indicator points (say $d_2$).

vi) $(d_2 - d_1)$ represents the expansion of cement.
Test to Check Consistency of Cement

CONSISTENCY
The basic aim is to find out the water content required to produce a cement paste of standard consistency as specified by the IS: 4031 (Part 4) – 1988. The principle is that standard consistency of cement is that consistency at which the Vicat plunger penetrates to a point 5-7mm from the bottom of Vicat mould.

Apparatus – Vicat apparatus conforming to IS: 5513 – 1976, Balance, whose permissible variation at a load of 1000g should be +1.0g, Gauging trowel conforming to IS: 10086 – 1982.

Procedure to determine consistency of cement
i) Weigh approximately 400g of cement and mix it with a weighed quantity of water. The time of gauging should be between 3 to 5 minutes.
ii) Fill the Vicat mould with paste and level it with a trowel.
iii) Lower the plunger gently till it touches the cement surface.
iv) Release the plunger allowing it to sink into the paste.
v) Note the reading on the gauge.
vi) Repeat the above procedure taking fresh samples of cement and different quantities of water until the reading on the gauge is 5 to 7mm.

Reporting of Results
Express the amount of water as a percentage of the weight of dry cement to the first place of decimal.

Vicat apparatus
Test to Check Initial and Final Setting Time of Cement

INITIAL AND FINAL SETTING TIME
We need to calculate the initial and final setting time as per IS: 4031 (Part 5) – 1988. To do so we need Vicat apparatus conforming to IS: 5513 – 1976, Balance, whose permissible variation at a load of 1000g should be +1.0g, Gauging trowel conforming to IS: 10086 – 1982.

Procedure to determine initial and final setting time of cement

i) Prepare a cement paste by gauging the cement with 0.85 times the water required to give a paste of standard consistency.
ii) Start a stop-watch, the moment water is added to the cement.
iii) Fill the Vicat mould completely with the cement paste gauged as above, the mould resting on a non-porous plate and smooth off the surface of the paste making it level with the top of the mould. The cement block thus prepared in the mould is the test block.

A) INITIAL SETTING TIME
Place the test block under the rod bearing the needle. Lower the needle gently in order to make contact with the surface of the cement paste and release quickly, allowing it to penetrate the test block. Repeat the procedure till the needle fails to pierce the test block to a point 5.0 ± 0.5mm measured from the bottom of the mould. The time period elapsing between the time, water is added to the cement and the time, the needle fails to pierce the test block by 5.0 ± 0.5mm measured from the bottom of the mould, is the initial setting time.

B) FINAL SETTING TIME
Replace the above needle by the one with an annular attachment. The cement should be considered as finally set when, upon applying the needle gently to the surface of the test block, the needle makes an impression therein, while the attachment fails to do so. The period elapsing between the time, water is added to the cement and the time, the needle makes an impression on the surface of the test block, while the attachment fails to do so, is the final setting time.

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