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*Indian Standard*

# **METHODS OF PHYSICAL TESTS FOR HYDRAULIC CEMENT**

**PART 5 DETERMINATION OF INITIAL AND FINAL SETTING TIMES**

*( First Revision )*

(Incorporating Amendment No. 1)

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**Price Group 1**

# Indian Standard

## METHODS OF PHYSICAL TESTS FOR HYDRAULIC CEMENT

### PART 5 DETERMINATION OF INITIAL AND FINAL SETTING TIMES

### ( *First Revision* )

#### 0. FOREWORD

**0.1** This Indian Standard (Part 5) (First Revision) was adopted by the Bureau of Indian Standards on 10 March 1988, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

**0.2** Standard methods of testing cement are essential adjunct to the cement specifications. This standard in different parts lays down the procedure for the tests to evaluate the physical properties of different types of hydraulic cements. The procedure for conducting chemical tests of hydraulic cement is covered in IS : 4032-1985\*.

**0.3** Originally all the tests to evaluate the physical properties of hydraulic cements were covered in one standard; but for facilitating the use of this standard and future revisions, it has been decided to print the different tests as different parts of the standard and, accordingly this revised standard has been brought out in thirteen parts. This will also facilitate updating of individual tests. Further, since publication of the original standard in 1968, a number of standards covering the requirements of

different equipment used for testing of cement, a brief description of which was also covered in the standard, had been published. In this revision, therefore, reference is given to different instrument specifications deleting the description of the instruments, as it has been recognized that reproducible and repeatable test results can be obtained only with standard testing equipment capable of giving desired level of accuracy. This part covers determination of initial and final setting times of cement.

**0.4** This edition 2.1 incorporates Amendment No. 1 (March 1993). Side bar indicates modification of the text as the result of incorporation of the amendment.

**0.5** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960\*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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\*Method of chemical analysis of hydraulic cement ( *first revision* ).

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\*Rules for rounding off numerical values ( *revised* ).

#### 1. SCOPE

**1.1** This standard (Part 5) covers the procedure for determining the initial and final setting times of cement.

#### 2. SAMPLING AND SELECTION OF TEST SPECIMEN

**2.1** The samples of the cement shall be taken in accordance with the requirements of IS : 3535-1986\* and the relevant standard specification for the type of cement being tested. The representative sample of the cement selected as above shall be thoroughly mixed before testing.

#### 3. TEMPERATURE AND HUMIDITY

**3.1** The temperature of moulding room, dry materials and water shall be maintained at  $27 \pm 2^\circ\text{C}$ . The relative humidity of the laboratory shall be  $65 \pm 5$  percent.

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\*Methods of sampling hydraulic cements ( *first revision* ).

**3.2** The moist closet or moist room shall be maintained at  $27 \pm 2^\circ\text{C}$  and at a relative humidity of not less than 90 percent.

#### 4. APPARATUS

**4.1 Vicat Apparatus** — Vicat apparatus conforming to IS : 5513-1976\*.

**4.2 Balance** — The balance shall conform to the following requirements:

On balance in use, the permissible variation at a load of 1 000 g shall be  $\pm 1.0$  g. The permissible variation on new balance shall be one-half of this value. The sensibility reciprocal shall be not greater than twice the permissible variation.

NOTE 1 — The sensibility reciprocal is generally defined as the change in load required to change the position of rest of the indicating element or elements of a non-automatic indicating scale a definite amount at any load.

NOTE 2 — Self-indicating balance with equivalent accuracy may also be used.

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\*Specification for Vicat apparatus ( *first revision* ).

**4.3 Standard Weights** — The permissible variations on weights in use in weighing the cement shall be as prescribed in Table 1.

**TABLE 1 PERMISSIBLE VARIATION  
ON WEIGHTS**  
( Clause 4.3 )

WEIGHT	PERMISSIBLE VARIATION ON WEIGHTS IN USE,
g	g
(1)	(2)
500	±0.35
300	±0.30
250	±0.25
200	±0.20
100	±0.15
50	±0.10
20	±0.05
10	±0.04
5	±0.03
2	±0.02
1	±0.01

**4.4 Gauging Trowel** — Gauging trowel conforming to IS : 10086-1982\*.

## 5. PROCEDURE

**5.1 Preparation of Test Block** — Prepare a neat cement paste by gauging the cement with 0.85 times the water required to give a paste of standard consistency. Potable or distilled water shall be used in preparing the paste. The paste shall be gauged in the manner and under the conditions prescribed in IS : 4031 (Part 4)-1988†. Start a stop-watch at the instant when water is added to the cement. Fill the Vicat mould *E* with a cement paste gauged as above, the mould resting on a nonporous plate. Fill the mould completely 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.

**5.1.1** Immediately after moulding, place the test block in the moist closet or moist room and

allow it to remain there except when determinations of time of setting are being made.

NOTE 1 — Clean appliances shall be used for gauging.

NOTE 2 — All the apparatus shall be free from vibration during the test.

NOTE 3 — Care shall be taken to keep the needle straight.

## 5.2 Determination of Initial Setting Time

— Place the test block confined in the mould and resting on the non-porous plate, under the rod bearing the needle (*C*); lower the needle gently until it comes in contact with the surface of the test block and quickly release, allowing it to penetrate into the test block. In the beginning, the needle will completely pierce the test block. Repeat this procedure until the needle, when brought in contact with the test block and released as described above, fails to pierce the block beyond  $5.0 \pm 0.5$  mm measured from the bottom of the mould. The period elapsing between the time when water is added to the cement and the time at which the needle fails to pierce the test block to a point  $5.0 \pm 0.5$  mm measured from the bottom of the mould shall be the initial setting time.

## 5.3 Determination of Final Setting Time

— Replace the needle (*C*) of the Vicat apparatus by the needle with an annular attachment (*F*). The cement shall be considered as finally set when, upon applying the needle gently to the surface of the test block, the needle makes an impression thereon, while the attachment fails to do so. The period elapsing between the time when water is added to the cement and the time at which the needle makes an impression on the surface of test block while the attachment fails to do so shall be the final setting time. In the event of a scum forming on the surface of the test block, use the underside of the block for the determination.

## 6. REPORTING OF RESULTS

**6.1** The results of initial and final setting time shall be reported to the nearest five minutes.

\*Specification for moulds for use in tests of cement and concrete.

†Methods of physical tests for hydraulic cement: Part 4 Determination of consistency of standard cement paste (first revision).

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