IS 4031 ( Part 14 ) : 1989

*Indian Standard*

( Reaffirmed 1995 )

# HYDRAULIC CEMENT — METHODS OF PHYSICAL TESTS

## PART 14 DETERMINATION OF FALSE SET

भारतीय मानक

## जल दृढ़ी सीमेंट — भौतिक परीक्षणों की पद्धतियाँ

### भाग 14 सीमेंट का आभासी जमाव

( First Reprint JANUARY 1993 )

UDC 666·94·015·57 : 666·9·015·59



BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

*February* 1990

Price Group 2

## FOREWORD

This Indian Standard (Part 14) was adopted by the Bureau of Indian Standards on 25 August 1989, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

Hydraulic cements sometimes exhibit false set or premature stiffening on gauging with water. But further working with the trowel breaks up this set and the cement regains its plasticity and exhibits a normal setting time. False set is totally distinct from flash set. Criteria for accepting a set in cement as false set has been specified in different Indian Standards on hydraulic cement. The Cement and Concrete Sectional Committee, therefore, felt it necessary to lay down the procedure for determining false set of hydraulic cement. This test is required to be carried out only when a false set is suspected in cement.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

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 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

# *Indian Standard*

# HYDRAULIC CEMENT — METHODS OF PHYSICAL TESTS

## PART 14 DETERMINATION OF FALSE SET

### 1 SCOPE

**1.1** This standard (Part 14) covers the procedure for determining false set of hydraulic cement.

### 2 REFERENCES

**2.1** The following Indian Standards are necessary adjuncts to this standard:

| *IS No.* | *Title* |
|---|---|
| 1433 : 1965 | Specification for beam scales (*revised*) |
| 3535 : 1986 | Methods of sampling hydraulic cements (*first revision*) |
| 5513 : 1976 | Specification for Vicat apparatus (*first revision*) |

### 3 SAMPLING AND SELECTION OF TEST SPECIMENS

**3.1** The sample of the cement shall be taken according to 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.

### 4 TEMPERATURE AND HUMIDITY

**4.1** The temperature of the moulding room, dry materials, appliances and water shall be maintained at 27 ± 2°C. The relative humidity of the laboratory shall be 65 ± 5 percent.

### 5 APPARATUS

#### 5.1 Vicat Apparatus

Vicat apparatus conforming to IS 5513 : 1976 shall be used.

#### 5.2 Balance

The balance shall conform to Class B of IS 1433 : 1965.

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

#### 5.3 Weights

The weights in use shall conform to the requirements specified in *Weights and Measures Rules*.

#### 5.4 Gauging Trowel

Gauging trowel shall have a steel blade 100 to 150 mm in length with straight edges and weighing 210 ± 10 g.

**5.5 Graduated Glass Cylinders,** 200 to 250 ml capacity.

#### 5.6 Mixing Slab

Mixing slab shall be of non-absorbent material of suitable size.

### 6 PROCEDURE

**6.1** Prepare a paste of weighed quantity of cement (500 g) with a weighed quantity (about 140 g) of potable or distilled water, taking care that the time of gauging is not less than three minutes nor more than four minutes and the gauging shall be completed before any sign of setting occurs. The gauging time shall be counted from the time of adding water to the dry cement until commencing to fill the Vicat mould. Fill the Vicat mould with this paste, the mould resting upon a non-porous plate. After completely filling the mould, smooth off the surface of the paste, making it level with the top of the mould. The mould may be slightly shaken to expel the air.

NOTE — Clean appliances shall be used for gauging.

**6.1.1** In filling the mould, the operator's hands and the blade of the gauging trowel shall alone be used.

**6.2** Place the test block confined in the mould, together with the non-porous resting plate, under the rod of Vicat apparatus bearing the plunger; lower the plunger gently to touch the surface of the test block, and quickly release, allowing it to sink into the paste. This operation of releasing the plunger shall be carried out exactly after 20 seconds of completion of mixing period.

#### 6.3 Determination of Initial Penetration

Prepare trial pastes with varying percentages of water as described above until the amount of

water necessary for making up the paste which will permit the Vicat plunger to penetrate to a point 28 to 36 mm from the top of the Vicat mould in 30 seconds of release of plunger is obtained.

### 6.4 Determination of Final Penetration

After completion of initial penetration reading, remove the plunger from the paste, clean it, and reset the mould and the plate in a new position. This operation should be performed with as little disturbance as possible to the paste confined in the Vicat mould. Bring the plunger again in contact with surface of the paste and release the plunger a second time, five minutes after completion of the mixing period and determine the final penetration after 30 seconds of release of plunger.

### 6.5 Determination of Remix Penetration

If the penetrations determined by the foregoing procedure show the cement to be stiffening rapidly, information as to the nature of stiffening shall be obtained by testing as given in **6.5.1** and **6.5.2**.

**6.5.1** After completing the measurement of the five minutes penetration, immediately return the paste to the mixing slab and remix the contents for one minute.

**6.5.2** Fill the mould and determine the penetration following the procedure specified in **6.3**.

NOTES

1 If early development of stiffness can be dispelled and plasticity regained by further mixing without addition of water then it is termed as false set.

2 If early development of stiffness cannot be dispelled nor can the plasticity be regained by further mixing without addition of water then it is termed as flash set.

## 7 CALCULATION

**7.1** Calculate the percent of *final* penetration as the ratio of *final* penetration to initial penetration as follows:

$$P = \frac{B}{A} \times 100$$

where

$P$ = percent final penetration,

$A$ = initial penetration in mm, and

$B$ = final penetration in mm.

## ANNEX A

### COMPOSITION OF THE TECHNICAL COMMITTEE

Cement and Concrete Sectional Committee, BDC 2

| *Chairman* | *Representing* |
|---|---|
| DR H. C. VISVESVARAYA | National Council for Cement and Building Materials, New Delhi |
| *Member* | |
| SHRI K. P. BANERJEE | Larsen and Toubro Limited, Bombay |
| SHRI HARISH N. MALANI ( *Alternate* ) | |
| SHRI S. K. BANERJEE | National Test House, Calcutta |
| CHIEF ENGINEER ( BD ) | Bhakra Beas Management Board, Nangal Township |
| SHRI J. C. BASUR ( *Alternate* ) | |
| CHIEF ENGINEER ( DESIGNS ) | Central Public Works Department, New Delhi |
| SUPERINTENDING ENGINEER ( S & S ) | |
| CHIEF ENGINEER ( RESEARCH-CUM-DIRECTOR ) | Irrigation Department, Government of Punjab |
| RESEARCH OFFICER ( CONCRETE TECHNOLOGY ) ( *Alternate* ) | |
| DIRECTOR | A. P. Engineering Research Laboratories, Hyderabad |
| JOINT DIRECTOR ( *Alternate* ) | |
| DIRECTOR | Central Soil and Materials Research Station, New Delhi |
| CHIEF RESEARCH OFFICER ( *Alternate* ) | |
| DIRECTOR ( C & MDD-II ) | Central Water Commision, New Delhi |
| DEPUTY DIRECTOR ( C & MDD-II ) ( *Alternate* ) | |
| SHRI V. K. GHANEKAR | Structural Engineering Research Centre ( CSIR ), Ghaziabad |
| SHRI S. GOPINATH | India Cements Limited, Madras |
| SHRI A. K. GUPTA | Hyderabad Industries Limited, Hyderabad |
| SHRI J. SEN GUPTA | National Buildings Organization, New Delhi |
| SHRI P. J. JAGUS | Associated Cement Companies Ltd, Bombay |
| DR A. K. CHATTERJEE ( *Alternate* ) | |
| JOINT DIRECTOR STANDARDS ( B & S )/CB-I | Research, Designs and Standards Organization ( Ministry of Railways ), Lucknow |
| JOINT DIRECTOR STANDARDS ( B & S )/CB-II | |
| SHRI N. G. JOSHI | Indian Hume Pipes Company Limited, Bombay |

| *Members* | *Representing* |
|---|---|
| SHRI R. L. KAPOOR | Roads Wing ( Ministry of Transport ), Department of Surface Transport, New Delhi |
| SHRI R. K. SAXENA (*Alternate*) | |
| SHRI G. K. MAJUMDAR | Hospital Services Consultancy Corporation ( India ) Ltd, New Delhi |
| SHRI P. N. MEHTA | Geological Survey of India, Calcutta |
| SHRI S. K. MATHUR ( *Alternate* ) | |
| DR A. K. MULLICK | National Council for Cement and Building Materials, New Delhi |
| SHRI NIRMAL SINGH | Development Commissioner for Cement Industry, ( Ministry of Industry ) |
| SHRI S. S. MIGLANI ( *Alternate* ) | |
| SHRI S. N. PAL | M. N. Dastur and Company Private Limited, Calcutta |
| SHRI BIMAN DASGUPTA ( *Alternate* ) | |
| SHRI R. C. PARATE | Engineer-in-Chief's Branch, Army Headquarters |
| LT-COL R. K. SINGH ( *Alternate* ) | |
| SHRI H. S. PASRICHA | Hindustan Prefab Limited, New Delhi |
| SHRI Y. R. PHULL | Indian Roads Congress, New Deihi; *and* Central Road Research Institute ( CSIR ), New Delhi |
| SHRI M. R. CHATTERJEE ( *Alternate* ) | Central Road Research Institute ( CSIR ), New Delhi |
| DR MOHAN RAI | Central Building Research Institute ( CSIR ), Roorkee |
| DR S. S. REHSI ( *Alternate* ) | |
| SHRI A. V. RAMANA | Dalmia Cement ( Bharat ) Limited, New Delhi |
| DR K. C. NARANG ( *Alternate* ) | |
| SHRI T. N. SUBBA RAO | Gammon India Limited, Bombay |
| SHRI S. A. REDDI ( *Alternate* ) | |
| DR M. RAMAIAH | Structural Engineering Research Centre ( CSIR ), Madras |
| DR A. G. MADHAVA RAO ( *Alternate* ) | |
| SHRI G. RAMDAS | Directorate General of Supplies and Disposals, New Delhi |
| SHRI A. U. RIJHSINGHANI | Cement Corporation of India, New Delhi |
| SHRI C. S. SHARMA ( *Alternate* ) | |
| SECRETARY | Central Board of Irrigation and Power, New Delhi |
| SHRI K. R. SAXENA ( *Alternate* ) | |
| SUPERINTENDING ENGINEER ( DESIGNS ) | Public Works Department, Government of Tamil Nadu |
| EXECUTIVE ENGINEER ( SMD DIVISION ) ( *Alternate* ) | |
| SHRI L. SWAROOP | Orissa Cement Limited, New Delhi |
| SHRI H. BHATTACHARYA ( *Alternate* ) | |
| SHRI S. K. GUHA THAKURTA | Gannon Dunkerley & Company Ltd, Bombay |
| SHRI S. P. SANKARNARAYANAN ( *Alternate* ) | |
| DR H. C. VISVESVARAYA | Institution of Engineers ( India ), Calcutta |
| SHRI D. C. CHATURVEDI ( *Alternate* ) | |
| SHRI G. Raman, Director ( Civ Engg ) | Director General, BIS ( *Ex-officio Member* ) |

*Secretary*

SHRI N. C. BANDYOPADHYAY
Joint Director ( Civ Engg ), BIS

## Cement, Pozzolana and Cement Additives Subcommittee, BDC 2 : 1

| *Convener* | |
|---|---|
| DR H. C. VISVESVARAYA | National Council for Cement and Building Materials, New Delhi |
| *Members* | |
| DR A. K. MULLICK<br>DR ( SHRIMATI ) S. LAXMI | ( *Alternates* to Dr H. C. Visvesvaraya ) |
| SHRI S. K. BANERJEE | National Test House, Calcutta |
| SHRI N. G. BASAK | Directorate General of Technical Development, New Delhi |
| SHRI T. MADNESHWAR ( *Alternate* ) | |
| SHRI SOMNATH BANERJEE | Cement Manufacturers Association, Bombay |
| CHIEF ENGINEER ( RESEARCH-CUM-DIRECTOR ) | Irrigation Department, Government of Punjab |
| RESEARCH OFFICER ( CT ) ( *Alternate* ) | |
| SHRI N. B. DESAI | Gujarat Engineering Research Institute, Vadodara |
| SHRI J. K. PATEL ( *Alternate* ) | |
| DIRECTOR | Maharashtra Engineering Research Institute, Nasik |
| RESEARCH OFFICER ( *Alternate* ) | |
| DIRECTOR ( C & MDD II ) | Central Water Commission, New Delhi |
| DEPUTY DIRECTOR ( C & MDD II ) ( *Alternate* ) | |
| SHRI R. K. GATTANI | Shree Digvijay Cement Company Ltd, Bombay |
| SHRI R. K. VAISHNAVI ( *Alternate* ) | |
| SHRI J. SEN GUPTA | National Buidings Organization, New Delhi |
| SHRI P. J. JAGUS | Associated Cement Companies Ltd, Bombay |
| DR A. K. CHATTERJEE ( *Alternate* ) | |
| JOINT DIRECTOR, STANDARDS ( B & S )/CB-I | Research, Designs and Standards Organization, Lucknow |
| JOINT DIRECTOR, STANDARDS ( B & S )/CB-II ( *Alternate* ) | |

| *Members* | *Representing* |
|---|---|
| SHRI R. L. KAPOOR | Roads Wing ( Ministry of Transport ), Department of Surface Transport, New Delhi |
| SHRI R. K. DATTA ( *Alternate* ) | |
| SHRI W. N. KARODE | Hindustan Construction Company Ltd, Bombay |
| SHRI R. KUNJITHAPATTAM | Chettinad Cement Corporation Ltd, Paliyur, Tamil Nadu |
| SHRI G. K. MAJUMDAR | Hospital Services Consulting Corporation ( India ) Ltd, New Delhi |
| SHRI K. P. MOHIDEEN | Central Warehousing Corporation, New Delhi |
| SHRI NIRMAL SINGH | Development Commissioner for Cement Industry ( Ministry of Industry ) |
| SHRI S. S. MIGLANI ( *Alternate* ) | |
| SHRI Y. R. PHULL | Central Road Research Institute ( CSIR ), New Delhi |
| SHRI M. R. CHATTERJEE ( *Alternate* ) | |
| SHRI A. V. RAMANA | Dalmia Cement ( Bharat ) Ltd, New Delhi |
| DR K. C. NARANG ( *Alternate* ) | |
| COL V. K. RAO | Engineer-in-Chief's Branch, Army Headquarters |
| SHRI N. S. GALANDE ( *Alternate* ) | |
| SHRI S. A. REDDI | Gammon India Ltd, Bombay |
| DR S. S. REHSI | Central Building Research Institute ( CSIR ), Roorkee |
| DR IRSHAD MASOOD ( *Alternate* ) | |
| SHRI A. U. RIJHSINGHANI | Cement Corporation of India Ltd, New Delhi |
| SHRI M. P. SINGH | Federation of Mini Cement Plants, New Delhi |
| SUPERINTENDING ENGINEER (D) | Public Works Department, Government of Tamil Nadu |
| SENIOR DEPUTY CHIEF ENGINEER ( GENERAL ) ( *Alternate* ) | |
| SHRI L. SWAROOP | Orissa Cement Ltd, New Delhi |
| SHRI H. BHATTACHARYA ( *Alternate* ) | |
| SHRI V. M. WAD | Bhilai Steel Plant, Bhilai |

**Standard Mark**

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

**Bureau of Indian Standards**

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.



**Revision of Indian Standards**

Indian Standards are reviewed periodically and revised, when necessary and amendments, if any, are issued from time to time. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition. Comments on this Indian Standard may be sent to BIS giving the following reference:

Doc : No. BDC 2 ( 4620 )

**Amendments Issued Since Publication**

| Amend No. | Date of Issue | Text Affected |
|---|---|---|
| | | |
| | | |
| | | |

BUREAU OF INDIAN STANDARDS

Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
( Common to all Offices )

| Regional Offices : | Telephone |
|---|---|
| Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002 | {311 01 31 {331 13 75 |
| Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola CALCUTTA 700054 | 37 86 62 |
| Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036 | 53 38 43 |
| Southern : C. I. T. Campus, IV Cross Road, MADRAS 600113 | 235 02 16 |
| Western : Manakalaya, E9 MIDC, Marol, Andheri ( East ) BOMBAY 400093 | 6 32 92 95 |

Branches : AHMADABAD, BANGALORE, BHOPAL, BHUBANESHWAR, COIMBATORE, FARIDABAD, GHAZIABAD, GUWAHATI, HYDERABAD, JAIPUR, KANPUR, PATNA, THIRUVANANTHAPURAM.

Reprography Unit, BIS, New Delhi, India