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IS 8041 (1990): Specification for rapid hardening Portland cement [CED 2: Cement and Concrete]



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*Indian Standard*  
**RAPID HARDENING PORTLAND CEMENT —  
SPECIFICATION**  
*( Second Revision )*

भारतीय मानक  
शीघ्र दृढ़ि भवन पोर्टलैंड सीमेंट — विशिष्ट  
( दूसरा पुनरीक्षण )

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

## FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards on 28 February 1990, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

This standard was first issued as an emergency standard in 1976 and subsequently revised in 1978. Since publication of the first revision of this standard, large number of amendments have been issued from time to time in order to modify various requirements based on experience gained with the use of the standard and the requirements of the users and also keeping in view the raw materials and fuel available in the country for manufacture of cement. The important amendments include modification in the tolerance requirements for the mass of cement packed in bags, permitting packaging of cement in 25 kg bags, incorporating a provision for issuing a certificate indicating the total chloride content in percent by mass of cement, etc. Moreover, IS 269 : 1976 'Specification for ordinary and low heat Portland cement (*third revision*)' which was referred to in this specification has also been revised. In view of these, the Sectional Committee decided to bring out the second revision of the standard incorporating all these amendments so as to make it more convenient for the users.

This specification covers the requirements of rapid hardening Portland cement.

Mass of cement packed in bags and the tolerance requirements for the mass of cement packed in bags shall be in accordance with the relevant provisions of the *Standards of Weights and Measures (Packaged Commodities) Rules, 1977* and **B-1.2** (*see Annex B for information*). Any modification in these rules in respect of tolerance on mass of cement would apply automatically to this standard.

The composition of the committee responsible for the formulation of this standard is given at Annex C.

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*

## RAPID HARDENING PORTLAND CEMENT— SPECIFICATION

### ( *Second Revision* )

#### 1 SCOPE

**1.1** This standard covers the manufacture and chemical and physical requirements of rapid hardening Portland cement.

NOTE — The term 'rapid hardening' should not be confused with 'quick-setting'.

#### 2 REFERENCES

**2.1** The Indian Standards listed in Annex A are necessary adjuncts to this standard.

#### 3 TERMINOLOGY

**3.1** For the purpose of this standard, the definitions given in IS 4845 : 1968 shall apply.

#### 4 MANUFACTURE

**4.1** Rapid hardening Portland cement shall be manufactured by intimately mixing together calcareous and argillaceous and/or other silica, alumina or iron oxide bearing materials, burning them at a clinkering temperature and grinding the resultant clinker so as to produce a cement capable of complying with this specification. No material shall be added after burning other than gypsum (natural or chemical) or water or both, and not more than one percent of air-entraining agents or other agents which have proved not to be harmful.

#### 5 CHEMICAL REQUIREMENTS

**5.1** When tested in accordance with the methods given in IS 4032 : 1985, rapid hardening Portland cement shall comply with the chemical requirements given in Table 1.

#### 6 PHYSICAL REQUIREMENTS

##### 6.1 Fineness

When tested for fineness in terms of specific surface by Blaine's air permeability method as described in IS 4031 (Part 2) : 1988, the specific surface of rapid hardening Portland cement shall be not less than 325 m<sup>2</sup>/kg.

##### 6.2 Soundness

**6.2.1** When tested by 'Le-Chatelier' method and autoclave test described in IS 4031

(Part 3) : 1988, unaerated cement shall not have an expansion of more than 10 mm and 0.8 percent respectively.

**6.2.1.1** In the event of cements failing to comply with any one or both the requirements specified in 6.2.1, further tests in respect of each failure shall be made as described in IS 4031 (Part 3) : 1988 from another portion of the same sample after aeration. The aeration shall be done by spreading out the sample to a depth of 75 mm at relative humidity of 50 to 80 percent for a total period of 7 days. The expansion of cements so aerated shall be not more than 5 mm and 0.6 percent when tested by 'Le-Chatelier' method and autoclave test respectively.

##### 6.3 Setting Time

The setting time of the cement, when tested by the Vicat apparatus method described in IS 4031 (Part 5) : 1988 shall conform to the following requirements:

- a) Initial setting time in minutes, not less than 30, and
- b) Final setting time in minutes, not more than 600.

**6.3.1** If cement exhibits false set, the ratio of final penetration measured after 5 min of completion of mixing period to the initial penetration measured exactly after 20 s of completion of mixing period, expressed as percent, shall be not less than 50 when tested by the method described in IS 4031 (Part 14) : 1989. In the event of cement exhibiting false set, the initial and final setting time of cement when tested by the method described in IS 4031 (Part 5) : 1988 after breaking the false set, shall conform to 6.3.

##### 6.4 Compressive Strength

The average compressive strength of at least three mortar cubes (area of face 50 cm<sup>2</sup>) composed of one part of cement and three parts of standard sand (conforming to IS 650 : 1966) by mass and P/4 + 3.0 percent (of combined mass of cement and sand) water, and prepared, stored and tested in the manner

described in IS 4031 ( Part 6 ) : 1988, shall be as follows:

- a) 24 hours                      Not less than 16 MPa  
     $\pm 30$  minutes
- b)  $72 \pm 1$  hours                Not less than 27 MPa

NOTE—P is the percentage of water required to produce a paste of standard consistency.

**Table 1 Chemical Requirements for Rapid Hardening Portland Cement**  
( Clause 5.1 )

Sl No.	Characteristic	Requirement
(1)	(2)	(3)
i)	Ratio of percentage of lime to percentages of silica, alumina and iron oxide, when calculated by the formula: $\frac{\text{CaO} - 0.7 \text{ SO}_3}{2.8 \text{ SiO}_2 + 1.2 \text{ Al}_2\text{O}_3 + 0.65 \text{ Fe}_2\text{O}_3}$	Not greater than 1.02 and not less than 0.66
ii)	Ratio of percentage of alumina to that of iron oxide	Not less than 0.66
iii)	Insoluble residue, percent by mass	Not more than 4 percent
iv)	Magnesia, percent by mass	Not more than 6 percent
v)	Total sulphur content calculated as sulphuric anhydride (SO <sub>3</sub> ), percent by mass	Not more than 2.5 and 3.0 when tricalcium aluminate (see Note 1) percent by mass is 5 or less and greater than 5 respectively
vi)	Total loss on ignition	Not more than 5 percent

#### NOTES

1 The tri-calcium aluminate content (C<sub>3</sub>A) is calculated by the formula:

$$C_3A = 2.65 (Al_2O_3) - 1.69 (Fe_2O_3)$$

where each symbol in brackets refers to the percentage (by mass of total cement) of the oxide, excluding any contained in the insoluble residue referred at Sl No. (iii).

2 Alkali aggregate reactions have been noticed in aggregates in some parts of the country. On large and important jobs where the concrete is likely to be exposed to humid atmosphere or wetting action, it is advisable that the aggregate be tested for alkali aggregate reaction. In the case of reactive aggregates, the use of cement with alkali content below 0.6 percent expressed as sodium oxide (Na<sub>2</sub>O), is recommended. Where, however, such cements are not available, use of Portland pozzolana cement or cement pozzolanic admixture is recommended.

3 Total chloride content in cement shall not exceed 0.05 percent by mass for cement used in prestressed concrete structures and long span reinforced concrete structures. (Method of test for determination of chloride content in cement is given in IS 12423 : 1988).

4 The limit of total chloride content in cement for use in plain and other reinforced concrete structures is being reviewed. Till that time, the limit may be mutually agreed to between the purchaser and the manufacturer.

6.4.1 Notwithstanding the strength requirements specified in 6.3, the cement shall show a progressive increase in strength from the strength at 24 hours.

6.5 By agreement between the purchaser and the manufacturer, transverse strength test of plastic mortar in accordance with the method described in IS 4031 ( Part 8 ) : 1988 may be specified in addition to the test specified in 6.3. The permissible values of the transverse strength for rapid hardening Portland cement shall be mutually agreed to between the purchaser and the supplier at the time of placing order.

## 7 STORAGE, SAMPLING, TESTS AND REJECTION

7.1 Storage, sampling, tests and rejection of rapid hardening Portland cement shall be as laid down in IS 269 : 1989 for 33 grade ordinary Portland cement.

## 8 MANUFACTURER'S CERTIFICATE

8.1 The manufacturer shall satisfy himself that the cement conforms to the requirements of this standard, and if requested, shall furnish a certificate to this effect to the purchaser or his representative, within ten days of despatch of the cement.

8.2 The manufacturer shall furnish a certificate, within ten days of despatch of the cement, indicating the total chloride content in percent by mass of cement.

## 9 DELIVERY

9.1 The cement shall be packed in bags [jute sacking, bag conforming to IS 2580 : 1982, double hessian bituminized (CRI type), multiwall paper conforming to IS 11761 : 1986, polyethylene lined (CRI type) jute, light weight jute conforming to IS 12154 : 1987, woven HDPE conforming to IS 11652 : 1986, woven polypropylene conforming to IS 11653 : 1986, jute synthetic union conforming to IS 12174 : 1987 or any other approved composite bags] bearing the manufacturer's name or his registered trade-mark, if any. The words 'Rapid Hardening Portland Cement' and the number of bags (net mass) to the tonne or the average net mass of the cement shall be legibly and indelibly marked on each bag. Bags shall be in good condition at the time of inspection.

9.1.1 The bags or packages may also be marked with the Standard Mark.

NOTE—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.

**9.2** The average net mass of cement per bag shall be 50 kg (*see* Annex B).

**9.2.1** The average net mass of cement per bag may also be 25 kg subject to tolerances as given in 9.2.1.1 and packed in suitable bags as agreed to between the purchaser and the manufacturer.

**9.2.1.1** The number of bags in a sample taken for weighment showing a minus error greater than 2 percent of the specified net mass shall be not more than 5 percent of the bags in the sample. Also the minus error in none of such bags in the sample shall exceed 4 percent of the specified net mass of cement in the bag. However, the average net mass of cement in a sample shall be equal to or more than 25 kg.

**9.3** Supplies of cement in bulk may be made by arrangement between the purchaser and the supplier (manufacturer or stockist).

NOTE — A single bag or container containing 1 000 kg or more net mass of cement shall be considered as bulk supply of cement. Supplies of cement may also be made in intermediate containers, for example, drums of 200 kg, by agreement between the purchaser and the manufacturer.

## ANNEX A

( Clause 2.1 )

### LIST OF REFERRED INDIAN STANDARDS

IS No.	Title	IS No.	Title
269 : 1989	33 Grade ordinary Portland cement ( <i>fourth revision</i> )	4845 : 1968	Definitions and terminology relating to hydraulic cement
650 : 1966	Standard sand for testing of cement ( <i>first revision</i> )	4905 : 1968	Methods for random sampling
2580 : 1982	Jute sacking bags for packing cement ( <i>second revision</i> )	11652 : 1962	High density polyethylene (HDPE) woven sacks for packing cement
3535 : 1986	Methods of sampling hydraulic cement ( <i>first revision</i> )	11653 : 1986	Polypropylene (PP) woven sacks for packing cement
4031 ( Parts 1 to Part 13 ) : 1988	Methods of physical tests for hydraulic cement ( <i>first revision</i> )	11761 : 1986	Specification for multiwall paper sacks for cement, valved-sewn-gusseted type
4031 ( Part 14 ) : 1989	Methods of physical tests for hydraulic cement: Part 14 Determination of false set	12154 : 1987	Light weight jute bags for packing cement
4032 : 1985	Method of chemical analysis of hydraulic cement ( <i>first revision</i> )	12714 : 1987	Jute synthetic union bag for packing cement
		12423 : 1988	Method for colorimetric analysis of hydraulic cement.



## ANNEX B

( Clause 9.2 )

TOLERANCE REQUIREMENTS FOR THE MASS OF CEMENT  
PACKED IN BAGS

**B-1** The average net mass of cement packed in bags at the plant in a sample shall be equal to or more than 50 kg. The number of bags in a sample shall be as given below:

<i>Batch Size</i>	<i>Sample Size</i>
100 to 150	20
151 to 280	32
281 to 500	50
501 to 1 200	80
1 201 to 3 200	125
3 201 and over	200

The bags in a sample shall be selected at random ( see IS 4905 : 1968 ).

**B-1.1** The number of bags in a sample showing a minus error greater than 2 percent of the

specified net mass ( 50 kg ) shall be not more than 5 percent of the bags in the sample. Also the minus error in none of such bags in the sample shall exceed 4 percent of the specified net mass of cement in the bag.

NOTE — The matter given in **B-1** and **B-1.1** are extracts based on the *Standards of Weights and Measures ( Packaged Commodities ) Rules, 1977* to which reference shall be made for full details. Any modification made in these Rules and other related Acts and Rules would apply automatically.

**B-1.2** In case of a wagon/truck load of 20 to 25 tonnes, the overall tolerance on net mass of cement shall be 0 to + 0.5 percent.

NOTE — The mass of a jute sacking bag conforming to IS 2580 : 1982 to hold 50 kg of cement is 531 g, the mass of a double hessian bituminized ( CRI type ) bag to hold 50 kg of cement is 630 g, the mass of a 6-ply paper bag to hold 50 kg of cement is approximately 400 g and the mass of a polyethylene lined ( CRI type ) jute bag to hold 50 kg of cement is approximately 480 g.

## ANNEX C

## COMMITTEE COMPOSITION

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**SHRI H. BHATTACHARYA ( Alternate )**  
**SHRI V. M. WAD**

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### 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: 323 01 31, 323 33 75, 323 94 02

Telegrams: Manaksanstha  
(Common to all offices)

### Regional Offices:

Telephone

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg  
NEW DELHI 110002

323 76 17, 323 38 41

Eastern : 1/14 C.I.T. Scheme VII M, V.I.P. Road, Maniktola  
CALCUTTA 700054

{ 337 84 99, 337 85 61  
337 86 26, 337 91 20

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022

{ 60 38 43  
60 20 25

Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113

{ 235 02 16, 235 04 42  
235 15 19, 235 23 15

Western : Manakalaya, E9 MIDC, Marol, Andheri (East)  
MUMBAI 400093

{ 832 92 95, 832 78 58  
832 78 91, 832 78 92

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR.  
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**AMENDMENT NO. 1 NOVEMBER 1991**  
**TO**  
**IS 8041 : 1990 RAPID HARDENING PORTLAND**  
**CEMENT — SPECIFICATION**

*(Second Revision)*

*(Page 3, clause 9.2.1.1) — Insert the following new clauses after 9.2.1.1 :*

**“9.2.2** When cement is intended for export and if the purchaser so requires, packing of cement may be done in bags other than those given in 9.2 and 9.2.1 with an average net mass of cement per bag as agreed to between the purchaser and the manufacturer.

**9.2.2.1** For this purpose the permission of the certifying authority shall be obtained in advance for each export order.

**9.2.2.2** The words ‘FOR EXPORT’ and the average net mass of cement per bag shall be clearly marked in indelible ink on each bag.

**9.2.2.3** The packing material shall be as agreed to between the supplier and the purchaser.

**9.2.2.4** The tolerance requirements for the mass of cement packed in bags shall be as given in 9.2.1.1 except the average net mass which shall be equal to or more than the quantity in 9.2.2.”

*(Page 4, clause B-1.2) — Substitute ‘up to 25 tonnes’ for ‘of 20 to 25 tonnes’.*

**(CED 2)**

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Reprography Unit, BIS, New Delhi, India

**AMENDMENT NO. 2 NOVEMBER 1993**  
**TO**  
**IS 8041 : 1990 RAPID HARDENING PORTLAND**  
**CEMENT — SPECIFICATION**

*( Second Revision )*

[ *Page 3, clause 9.2.1.1 ( see also Amendment No. 1 )* ] — Substitute the following for the existing matter:

**‘9.2.2** When cement is intended for export and if the purchaser so requires, packing of cement may be done in bags or in drums with an average net mass of cement per bag or drum as agreed to between the purchaser and the manufacturer.

**9.2.2.1** For this purpose the permission of the certifying authority shall be obtained in advance for each export order.

**9.2.2.2** The words ‘FOR EXPORT’ and the average net mass of cement per bag/drum shall be clearly marked in indelible ink on each bag/drum.

**9.2.2.3** The packing material shall be as agreed to between the manufacturer and the purchaser.

**9.2.2.4** The tolerance requirements for the mass of cement packed in bags/drum shall be as given in 9.2.1.1 except the average net mass which shall be equal to or more than the quantity in 9.2.2.’

**AMENDMENT NO. 3   APRIL 2000**  
**TO**  
**IS 8041 : 1990   RAPID HARDENING PORTLAND**  
**CEMENT — SPECIFICATION**  
*( Second Revision )*

Substitute 'net mass' for 'average net mass' wherever it appears in the standard.

( CED 2 )

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Reprography Unit, BIS, New Delhi, India

**AMENDMENT NO. 4 MAY 2004**  
**TO**  
**IS 8041 : 1990 RAPID HARDENING PORTLAND**  
**CEMENT — SPECIFICATION**

*( Second Revision )*

*( Page 1, clause 6.3.1, line 6 ) — Substitute 'less than' for 'not less than'.*

( CED 2 )

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