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मानक

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“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

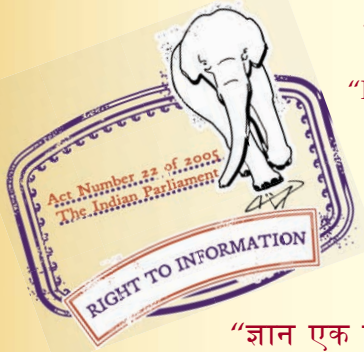
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 5410 (1992): Cement paint [CHD 20: Paints, Varnishes and Related Products]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



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IS 5410 : 1992  
(Reaffirmed 2009)

भारतीय मानक  
सीमेन्ट रंग रोगन – विशिष्ट  
( पहला पुनरीक्षण )

*Indian Standard*

CEMENT PAINT — SPECIFICATION  
( First Revision )

First Reprint FEBRUARY 1996

UDC 667. 636.25 : 691.57

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

November 1992

Price Group 6

## FOREWORD

This standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Paints (Other than Industrial Paints) Sectional Committee had been approved by the Chemical Division Council.

Cement paint is a material consisting of Portland cement and other ingredients like lime, pigments, hygroscopic salts, water repellants, fungicides, etc. The material readily mixes with water and is used on porous surfaces like masonry, concrete, rough plaster except gypsum plaster. These paints have relatively better performance than distemper paints for outdoor protection and decoration of buildings. In view of the growing demand for this material, this standard was formulated in 1969. The need to ensure absence of organic binding materials and the fungistatic action of cement paint were considered important. While test for freedom from organic binders had been included in this standard, inclusion of a test for fungistatic properties will be considered at a later date when facilities are available for commercial testing

This revision has been taken up to incorporate the changes based on the experience gained in two decades of the existence of this standard and to bring it at par with the present day technology. In this revision, test methods for determination of free time, chlorides and loss on ignition have been modified.

As the percent of all the raw materials is not mentioned in the standard, the loss on ignition value for individual raw materials cannot be calculated and taken into consideration, it was felt that various difficulties can be removed if the cement paint composition is not less than 65 percent ordinary portland cement and also it satisfies all the performance requirement.

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.

**AMENDMENT NO. 4 JULY 2010**  
**TO**  
**IS 5410 : 1992 CEMENT PAINT — SPECIFICATION**

*( First Revision )*

*(Page 6, clause B-3.1.6, lines 2 and 3)* — Delete the following matter:

‘(a porcelain crucible may also be used).’

(CHD 20)

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Reprography Unit, BIS, New Delhi, India

**AMENDMENT NO. 3 DECEMBER 1997**  
**TO**  
**IS 5410 : 1992 CEMENT PAINT — SPECIFICATION**  
*(First Revision)*

( Page 4, clause **B-3.1.1**, line 15 ) — Insert the following words between 'hot saturated ammonium' and 'oxalate becomes granular':  
'oxlate solution, stir and continue the boiling until the precipitated caccium'.

(CHD 020)

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Reprography Unit, BIS, New Delhi, India

**AMENDMENT NO. 2 JANUARY 1995**  
**TO**  
**IS 5410 : 1992 CEMENT PAINT — SPECIFICATION**

*(First Revision)*

*(Page 1, clause 4.4)* — Add the following new clause 4.5 after clause 4.4 and renumber the subsequent clause:

**4.5 Keeping Property**

The material shall conform to all the requirements given in Table 1, for a period of minimum one year from the date of manufacture, when stored in original sealed containers under normal atmospheric conditions.

{ Page 2, Table 1, S/No (ix) } — Delete

{ Page 3, Annex A } — Delete the entry '101 (Part 6, Sec 2) - 1990 Part 6 Durability tests, Sec 2 Keeping properties (*Amended*)'.

( C110193 )



**AMENDMENT NO. 1 JUNE 1993**  
**TO**  
**IS 5410:1992 CEMENT PAINT—SPECIFICATION**

*(First Revision)*

*(Foreword, second cover )* — Add the following after para 4:

'A scheme for labelling environment friendly products to be known as ECO Mark is being introduced at the instance of the Ministry of Environment and Forests (MEF). The ECO Mark shall be administered by the Bureau of Indian Standards (BIS) under the BIS Act, 1986 as per the Resolution No. 71 dated 20 February 1991 published in the Gazette of the Government of India. For a product to be eligible for ECO Mark it shall also carry Standard Mark of BIS for quality besides meeting additional optional environment friendly (EF) requirements. This amendment is, therefore, being issued to this standard to include EF requirements for cement paint.'

*(Page 1, clause 4.5)* — Add the following after 4.5:

**4.6 Optional Requirement for ECO Mark**

**4.6.1 General Requirements**

**4.6.1.1** The product shall conform to the requirements for quality, safety and performance prescribed under clauses 4.1 to 4.5.

**4.6.1.2** The manufacturer shall produce to BIS environmental consent clearance from the concerned State Pollution Control Board as per the provisions of Water (Prevention and Control of Pollution) Act, 1974 and Air (Prevention and Control of Pollution) Act, 1981 along with the authorization, if required under the Environment (Protection) Act, 1986 and rules made thereunder, while applying for ECO Mark.

**4.6.2 Specific Requirements**

**4.6.2.1** The product shall contain not more than 5 percent, by mass, Volatile Organic Compounds, when tested according to the method prescribed in IS 101 ( Part 2/Sec 1 ) : 1988 and IS 101 ( Part 2/Sec 2 ) : 1986.

**4.6.2.2** The product shall not contain more than 0.1 percent, by mass (as metal), of any toxic metals such as lead, cadmium, chromium ( VI ) and their compounds when tested by the relevant Atomic Absorption Spectrophotometric methods.

**4.6.2.3** The product shall not be manufactured from any carcinogenic ingredients.

*NOTE* — The Central Drugs Research Institute and Industrial Toxicological Research Centre would furnish a list of carcinogenic ingredients to BIS and would also keep BIS informed about the changes therein.'

*(Page 1, clause 5.1)* — Add the following after 5.1:

**5.1.1** The ECO Marked product shall be packed in such packages which shall be recyclable/reusable or biodegradable. It shall be accompanied with instructions for proper use so as to maximise product performance and minimise wastage.

*NOTE* — Subsequently the parameters evolved for packaging material/packages for ECOMARK, which are being separately notified/circulated, shall also apply.'

*(Page 1, clause 5.2)* — Add the following new clause after 5.2:

**5.2.1** In case of products certified for ECO Mark three major ingredients and hazardous chemicals shall be marked on the container.

**5.2.1.1** The criteria for which the product has been been labelled as ECO Mark may also be marked on the container.'

# Indian Standard

## CEMENT PAINT—SPECIFICATION

### (First Revision)

#### 1 SCOPE

This standard prescribes requirements and methods of sampling and test for cement paint, colour as required. The material is intended for use on walls, ceiling, and as an interior or exterior decorative and protective finish.

#### 2 REFERENCES

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 1303 - 1983 and the following shall apply.

**3.1.1 Volatile Organic Compounds (VOC)** — It is defined as the volatile matter content minus the water content.

#### 4 REQUIREMENTS

##### 4.1 Composition

The material, on analysis as prescribed in Annex B, shall show a chemical composition as given below. The composition of the bulk supply shall be similar to that of the registered sample:

	<i>Percent by Mass</i>
Portland cement	65 <i>Min</i>
Hydrated lime	25 <i>Max</i>

Alkali resistant pigments Water repellants Hygroscopic salts Fungicides	}	In suitable proportions to produce a material to satisfy the requirements of this standard.
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##### 4.1.1 Freedom from Organic Binders

The material shall be free from organic binders, when tested as prescribed in Annex C.

##### 4.2 Preparation for Use

The material shall be in the powder form, free from lumps that are not friable and when mixed with

required volume of water shall be suitable for use on porous surfaces of masonry, concrete, stucco, common brick and rough plaster work, except gypsum plaster. The surface to which the paint is applied shall be free from chalking or other extraneous matter which interfere with the adhesion of the paint to the surface.

**4.3** The water mixed paint shall be kept well stirred during use and shall be applied within one hour of preparation. The surface to be painted shall be wetted with water before application.

##### 4.4 Durability

When prepared and tested for normal outdoor exposure as prescribed under **D-4**, a general breakdown of the film prepared from the registered sample, shall not occur in less than 18 months.

NOTE — As a precaution against inadvertent accidents, the outdoor exposure test (D-4) shall be carried out in duplicate.

**4.5** The material when mixed with equal volume of water shall also comply with the requirements given in Table 1.

#### 5 PACKING AND MARKING

##### 5.1 Packing

Unless otherwise agreed to, the dry material shall be packed in polyethylene bags in suitable metal/plastic containers.

##### 5.2 Marking

Each container shall be marked with the following:

- a) Name of the material;
- b) Indication of the source of manufacture;
- c) Mass of the material; and
- d) Month and year of manufacture.

#### 6 SAMPLING

**6.1** Representative samples of the material shall be drawn as prescribed in IS 101 (Part 1/Sec 1) : 1986.

**Table 1 Requirements for Cement Paint**  
(Clauses 4.5 and 7.1)

Sl No.	Character	Requirement	Method of Test, Ref to	
			Annex (4)	IS 101 (5)
(1)	(2)	(5)		
i)	Drying time ( Hardening ) and recoating propertie	Not more than 24 hours	E	—
ii)	Finish	Smooth and malt	—	Part 3/Sec 4 1989
iii)	Colour	Close match to the specified IS colour or is agreed to	—	Part 4/Sec 2 : 1989
iv)	Fastness to light (using ??? as in D-1.1.1)	To pass the test	—	Part 4/Sec 3: 1988
v)	Residue on sieve (on dry	5.0	F	—
vi)	Resistance in dry rubbing	To pass the test	G	—
vii)	Water repellency	To pass the test	H	—
viii)	Pot life mixed paint	Not less than 1 hour	J	—
ix)	Keeping properties (on dry material)	Not less than 1 year	—	Part 6/Sec 2: 1990

## 7 TEST METHODS

**7.1** Test shall be conducted recording to the methods referred to in **4.1, 4.1.1, 4.4** col 4 and 5 of Table 1.

**7.1.1** For match against IS colour. SP 1650 : 1973 be used.

## 7.2 Quality of Reagents

Unless specified otherwise, pure chemicals and distilled water (*see* IS 1070 : 1992) shall be employed in tests.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the result of analysis.

**ANNEX A**

( Clause 2 )

**LIST OF REFERRED INDIAN STANDARDS**

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
101 ( Part 1/ Sec 1 ) : 1986	Methods of sampling and test for paints, varnishes and related products Part 1 Test on liquid paints ( general and physical ), Sec 1 Sampling ( <i>third revision</i> )	101 ( Part 4/ Sec 3 ) : 1988	Part 4 Optical teste on paint films, Sec 3 Light fastness test ( <i>third revision</i> )
101 ( Part 2/ Sec 1 ) : 1987	Part 2 Test on liquid paints ( Chemical examination ), Sec 1 Water content ( <i>third revision</i> )	101 ( Part 6/ Sec 2 ) : 1990	Part 6 Durability tests. Sec 2 Keeping proprties ( <i>third revision</i> )
101 ( Part 2/ Sec 2 ). 1987	Part 2 Test on liquid paints (Chemical examination ), Sec 2 Volatile matter ( <i>third revision</i> )	269 : 1976	Ordinary and low beat Portland cement ( <i>third revision</i> )
101 ( Part 3/ Sec 4 ) : 1989	Tests on paint film formation, Sec 4 Finish ( <i>third revision</i> )	650 : 1966	Standard sand for testing of cement ( <i>first revision</i> )
101 ( Part 4/ Sec 2 ) : 1989	Part 4 Optical tests on paint films, Sec 2 Colour ( <i>third revision</i> )	1070 : 1992	Reagent grade water — Specification ( <i>third revision</i> )
		1303 . 1983	Glossary of terms relating to paints ( <i>second revision</i> )
		1650 : 1973	Colours for building and decorative finishes

**ANNEX B**

( Clause 4.1 )

**ANALYSIS OF CEMENT PAINT****B-0 GENERAL****B-0.1 Outline of the Methods**

The analysis consists of determination of Portland cement, total hydrated time, and unhydrated calcium oxide and magnesium oxide in hydrated time.

**B-1 APPARATUS****B-1.1 Beakers****B-1.2 Long-Necked Flasks**

**B-1.3 Reflux Condenser** — of suitable size.

**B-1.4 Platinum Crucible or Silica Crucible** — pf 20 to 30 ml capacity.

B-1.5 Gooch Crucible

B-1.6 Carbon Dioxide Absorption Train

B-1.7 Electric Furnae

**B-2 REAGENTS**

B-2.1 Ammonium Chloride

B-2.2 Bromine Water — prepared by saturating freshly distilled water with bromine

B-2.3 Ammonium Hydroxide Solution

B-2.4 Ammonium Oxalate Solution — saturated.

B-2.5 Sulphuric Acid, dilute

Mix one volume of sulphuric acid with 5 volumes of water.

B-2.6 Standard Potassium Permanganate Solution — 0.1 N.

B-2.7 Neutral Glycerine - Alcohol Solution 1 : 5.

Mix 1 part by volume of glycenne with 5 parts by volume of absolute alcohol. To each litre of solution add 2 ml of phenolphthalein indicator solution. It is necessary that the glycenn-alcohol solution should be neutral. If the solution is colourless after addition of indicator, add dilute solution of alcoholic sodium or potassium hydroxide until the pink colour appears and first remove this by addition of alcoholic ammonium acetate solution in drops. If the initial colour is pink, remove it by addition of alcoholic ammonium acetate solution.

**B-2.8 Standard Ammonium Acetate Solution  
(1 ml = 0.005 g calcium oxide)**

Prepare the solution by dissolving 16 g of crystalline ammonium acetate ( See Note ) in one litre of ethanol. Standardize this solution by titrating against pure calcium oxide that is freshly prepared by calcining pure calcium carbonate or calcium oxalate in a platinum crucible at 900° to 1 000°C to constant weight. When the calcined calcium oxide has cooled in a desiccator, perform the operations described under B-2.8.1 in quick succession.

NOTE — Ammonium acetate is generally sold in a damp condition and should be as dry as possible. It may be dried by placing over a dehydrating agent, such as sulphuric acid or fused anhydrous calcium chloride contained in a desiccator for two weeks or more.

**B-2.8.1** Grind it in an agate mortar, weigh out 0.05 to 0.06 g into a dry 200 or 250-ml Erlenmeyer flask, and add 60 ml of the glycerol ethanol solvent to the flask ( see Note 1 ). In order to minimize the danger of hydration and carbonation, separate samples of pure calcium carbonate may be calcined in small sized platinum capsules. The calcium oxide thus produced is cooled in a desiccator, re-weighed for a check and introduced in the flask. The grinding of oxide may be unnecessary if original calcium carbonate is in a finely powdered form. Dispense the calcium oxide in the solution by shaking the flask and attach a reflux condenser ( see Note 2 ). Boil the mixture. The ebullition should be positive but not so violent as to cause bumping or excessive evaporation. Then remove the condenser and immediately titrate the solution, while near boiling, with the standard ammonium acetate solution. Replace the condenser and boil the solution again. Repeat the titrations at intervals ( see Note 3 ). Shake the flask frequently between titrations to shorten the time required for the boiling. The titration is complete when no further colour appears in the solution during continuous boiling for one hour ( see Note 4 ). Calculate the calcium oxide equivalent of the ammonium acetate solution in grams per millilitre by dividing the mass of calcium oxide used by the volume of solution required.

**NOTES**

1 Sometimes pure calcium oxide will take on the bottom of the flask, particularly if the glycerol is anhydrous. This trouble may be avoided by putting a few grams of clean dry quartz sand in the flask before the introduction of calcium oxide and solvent.

2 If a new stopper is used and has white powder on it, it should be thoroughly washed before using. A glass tube about 6 mm in diameter and 50 to 100 cm in length because a loss of alcohol is liable to occur through evaporation. In such a case it is necessary to add neutralized ethanol from time to time to maintain the same proportion of glycerol to ethanol. If the proportion is greater than one to three, a partial decomposition of cement may take place. Instead of an ordinary flask, plain tubing and a stopper, a flask with a ground-in glass stopper and condenser tube may be used, preferably one with a standard taper joint. A water-cooled condenser is the most satisfactory and it may be as short as 30 cm. Some loss of alcohol may also occur through

dripping from the condenser during the titrations and should be compensated for by the addition of neutralized ethanol.

3 In general, the intervals may be of 20 minutes but they will chiefly depend on the rapidity of the dissolution of calcium oxide. They may be of 5 to 10 minutes in the beginning and then be increased to 30 minutes or one hour in the end. If the solution contains a large amount of dissolved calcium oxide and the boiling is continued a long time without titration, crystals (probably of calcium glycinate) may form which dissolve slowly and increase the time required for the completion of the titration.

4 The end point will not be the same for a hot solution and a cold solution, especially when a large amount of calcium acetate is present. The titration should always be carried out while the solution is boiling hot. If the end point is determined accurately, the solution will turn pink upon cooling, and this can serve as evidence that the end point has not been greatly overstepped.

**B-2.9 Hydrochloric Acid — 1 : 2.**

Mix 1 volume of hydrochloric acid with 2 volumes of distilled water.

**B-2.10 Ammonium Phosphate Solution**

Saturate freshly distilled water with dibasic ammonium phosphate.

**B-2.11 Ammonium Hydroxide Solution****B-2.12 Potassium Chromate Indicator Solution**

Dissolve 5 g of potassium chromate in 100 ml of water.

**B-2.13 Standard Silver Nitrate Solution — 0.1 N****B-3 PROCEDURE**

**B-3.1** Carry out the analysis on the material as received.

**B-3.1.1 Total Calcium Oxide**

Weigh accurately about 0.5 g of the material and mix with 0.5 g of ammonium chloride in a 50 ml beaker. Add 5 ml of hydrochloric acid, cover the beaker and heat over a water bath for 15 minutes. Transfer the gel completely to a Gooch filter and wash the insoluble residue thoroughly with hot water. Discard the residue and preserve the filtrate. To the filtrate add 8 to 10 g of ammonium chloride. Bring to near boiling, add a few millilitres of bromine water and make alkaline with ammonium hydroxide solution. Allow the precipitate to settle, filter and wash thoroughly with hot water. Concentrate the filtrate to about 200 ml, adding a few drops of ammonium hydroxide. Boil and add while boiling 25 to 30 ml of hot saturated ammonium oxalate becomes granular. Set aside over a water-bath for one hour. Filter and wash the precipitate with small amounts of hot water. Preserve the filtrate for magnesium oxide determination ( B-3.1.3 ). Transfer the moist precipitate to a 400-ml beaker by means of a stream of water from a wash bottle, dissolve the precipitate adhering to the filter paper with warm dilute sulphuric acid and catch it in the beaker. Add to the beaker 20 ml of dilute sulphuric

acid, dilute to 300 ml with hot water and titrate the hot solution against standard potassium permanganate solution.

Calculate the amount of calcium oxide ( as CaO ) present in the material using the following formula:

1 ml of 0.1 N Potassium permanganate = 0.0023 g of calcium oxide

#### B-3.1.2 Free Lime

The method does not differentiate between free calcium oxide and free calcium hydroxide, thus any free calcium hydroxide that may be present will be included in the determination and calculated as free calcium oxide.

Weigh one gram of material into a flask, for the determination of free calcium oxide and add 60 ml of the solvent to the flask and proceed as in the standardization of the ammonium acetate solution ( see B-2.8 ). The end point is considered to have been reached when the content of free calcium oxide in the sample does not increase by more than 0.05 percent during the last two hours of boiling.

NOTE— Avoid unnecessary exposure of the sample to the atmosphere

**B-3.1.2.1** No excess of ammonium acetate shall be added at any time because an excess of it may react with calcium aluminate and silicates. To avoid such excess, use a small burette or measuring pipette fitted with a glass stopcock or a rubber pinchcock and small tip which delivers about 50 drops per millilitre. If the titrations are far apart and the reagent evaporates in the lip, a few drops may be discarded before each titration and the drops used in titration may be counted and converted in terms of millilitres. It is good precaution to allow a slight pink colour to remain in the solution after each of the early titrations.

Vigorous boiling is more essential with cement than with pure calcium oxide and, if possible, should be so conducted that it is not necessary to shake the flask vigorously at intervals. The flask should not be shaken vigorously while it is disconnected from the condenser because the solvent, if superheated, may boil, expel alcohol vapour and then draw in air carrying water and carbon dioxide. A good procedure is to bring the solution and sample to boiling rapidly over a Bunsen flame in the beginning before placing the flask on a hot plate and connecting it with the condenser. If there is a tendency to bump, it may be reduced by adding glass beads or pure quartz sand to the flask or putting a thin mat of asbestos between the flask and the hot plate.

If in the final titrations there is doubt as to the exact end point, add a drop of the phenolphthalein indicator to the quiescent liquid in the flask and carefully observe the point where the indicator strikes the liquid. If no colour appears, the end point has been reached. If the sample settles during

boiling and leaves a partially clear layer of solution, another way to overcome difficulty in discerning a change in the colour of the solution is to swirl the flask after the addition of the solution of ammonium acetate so as to avoid the dispersion of the sample. A strong daylight lamp with a reflector may be used as an aid in the discernment of the end point. The contents of the flask may be matched with similar contents in another flask which contains an excess of ammonium acetate.

If it is necessary to leave the determination incomplete, remove the flask, add just enough ammonium acetate to discharge the pink colour and stopper the flask tightly. When renewing the determination, boil the mixture before repeating the titrations.

Calculate the percent of free calcium oxide to the nearest 0.1 as follows;

$$\text{Free calcium oxide (CaO), percent} = EV \times 100$$

where

$E$  = CaO equivalent of the ammonium acetate solution in grams per millilitre, and

$V$  = millilitres of ammonium acetate solution required by the sample.

#### B-3.1.3 Total Magnesium Oxide

Acidify the filtrate obtained from B-3.1.1 with hydrochloric acid, concentrate the solution over a water-bath to about 150 ml and make slightly alkaline with ammonium hydroxide solution. Boil and filter to remove traces of iron, aluminium and calcium. Cool, acidify with hydrochloric acid, add 10 ml of saturated ammonium phosphate. Add ammonium hydroxide drop by drop with constant stirring. When the crystalline ammonium magnesium phosphate has been formed, add 10 ml of the ammonium hydroxide in excess. Set aside overnight in a cool place, filter and wash with 2.5 percent ammonia solution. Dissolve the precipitate in a small quantity of but hydrochloric acid, dilute to about 100 ml and add 1 ml of ammonium phosphate solution and ammonium hydroxide drop by drop, with constant stirring, until the precipitate is again formed. Allow the precipitate to stand for 2 hours filter and ??? Place the filter paper with contents ??? platinum crucible, char the paper ??? and carefully burn off the resulting carbon ??? the precipitate to constant weight over a surface burner. Cool and weigh the precipitate. Calculate the amount of magnesium oxide by multiplying the mass of precipitate obtained by 0.362.

#### B-3.1.4 Carbon Dioxide

Weigh accurately about 5 g of the material and transfer to a small long-necked flask. Put this flask in a carbon dioxide train consisting of an upward inclined condenser, U-tubes containing calcium chloride, anhydrous cupric sulphate and calcium chloride, then a U-tube filled with porous soda lime, a U-tube containing half soda lime and half

## IS 5410 : 1992

calcium chloride and an additional U-tube containing only soda lime and the last U-tube containing only calcium chloride. Pour some hot water to the material in the long-necked flask, connect the flask to the train and pass a current of carbon dioxide free air through all the train except soda lime tubes. Weigh and attach the soda lime tubes. Add some dilute hydrochloric acid into the flask slowly. When any apparent action has ceased, heat the flask gradually to boiling and continue boiling until no more gas is evolved. Cool, pass a current of carbon dioxide-free air throughout the experiment. Detach and close the soda lime tubes, let stand in a balance case, weigh them at 30 minutes intervals until two successive weighings agree within 0.5 mg. Record the gain in mass of soda lime tubes as the mass of carbon dioxide.

### B-3.1.5 Chlorides

Weigh about 2 g of the material accurately into a 100-ml beaker and add about 20 ml of water, stir well and set aside for 30 minutes. Filter the contents through a filter paper into a 250-ml volumetric flask. Wash the residue on the filter a few times with water, catch the washings also in the volumetric flask and make up to the mark. Pipette out 50 ml of the solution into a conical flask and add 3-4 drops of methyl orange (0.1 g in 50 ml of rectified spirit and made up to 250 ml with water). Add potassium nitrate solution (1 : 10 by volume in water) in such a quantity so that red colour is obtained. Add solid calcium carbonate in such a quantity that red colour disappears and yellow (or yellowish white) colour is obtained. Add 1 ml of neutral potassium chromate indicator solution. Titrate the solution against standard silver nitrate solution slowly swirling the contents of the flask constantly until the first colour change from yellow is observed. The titration is continued further by adding the silver nitrate solution in drops to a faint red-brown colour which persists even after brisk shaking calculate the amount of chloride present in the material as follows:

$$\text{Chloride (as Cl), percent by mass} = \frac{V \times N \times 17.75}{W}$$

where

V = volume, in ml, of standard silver nitrate solution used;

N = normality of standard silver nitrate solution; and

W = mass, in g, of the material taken for test.

### B-3.1.6 Loss on Ignition

Heat 1.00 g of the sample for 15 minutes in a weighed and covered platinum crucible (a porcelain crucible may also be used) of 20 to 25 ml capacity by placing it in a muffle furnace at temperature between 900 °C and 1 000 °C, cool and weigh. Check the loss in mass by a second

heating for 5 minutes and re-weigh. Record the loss in mass as the loss on ignition and calculate the percent loss on ignition to the nearest 0.1. Calculate the percent loss on ignition as below:

$$\text{Percent loss on ignition} = \text{loss in mass} \times 100$$

### B-3.1.7 Free or Extraneous Water

Weigh about 1 g of the material accurately into tared platinum crucible and dry the material in a suitable electric furnace at 350°C for 30 minutes. Cool in a desiccator and weigh rapidly. The loss in mass gives the free or extraneous water.

## B-4 REPORT

**B-4.1** Compute the percentages of Portland cement, hydrated lime and the percent of the sum of unhydrated calcium oxide and magnesium oxide in the hydrated lime in the material is given in **B-4.1.1** to **B-4.1.2.14**.

### B-4.1.1 Portland Cement

Compute the amount of calcium oxide combined with carbon dioxide (**B-3.1.4**) and also with chloride (**B-3.1.5**) and add to the amount of free lime (**B-3.1.2**). Subtract this sum from the total calcium oxide (**B-3.1.1**) and multiply the difference by 1.56 (Note). Report this value as the percentage of Portland cement.

NOTE — The factor 1.56 is based on the assumption that portland cement contains on average 64 percent of calcium oxide.

### B-4.1.2 Total Hydrated Lime, and Percent of Unhydrated Calcium Oxide and Magnesium Oxide in Hydrated Lime

From the total magnesium oxide value (**B-3.1.3**) subtract 3.0 percent of computed Portland cement (**B-4.1.1**) to determine magnesium oxide in the hydrated lime.

NOTE — The factor 3.0 percent is to make allowance for magnesium oxide which may be present in Portland cement to a maximum of 6 percent.

**B-4.1.2.1** From the loss of ignition (**B-3.1.6**) subtract the sum of free water (**B-3.1.7**) and carbon dioxide (**B-3.1.4**) to determine the percentage of combined water.

**B-4.1.2.2** Multiply the free lime (**B-3.1.2**) by 0.321 to determine the percentage of water combined with calcium oxide.

**B-4.1.2.3** If the value in **B-4.1.2.2** is less than the combined water (**B-4.1.2.1**), proceed as in **B-4.1.2.4** to **B-4.1.2.3** inclusive. If the value in **B-4.1.2.2** is greater than the combined water (**B-4.1.2.1**) proceed as in **B-4.1.2.10** to **B-4.1.2.13** inclusive. If the value in **B-4.1.2.2** is equal to combined water (**B-4.1.2.1**), compute total lime as in **B-4.1.2.2** and unhydrated lime as in **B-4.1.2.14**.



**B-4.1.2.4** Subtract the value obtained in **B-4.1.2.2** from combined water (**B-4.1.2.1**). This gives the percentage of water combines with magnesium oxide.

**B-4.1.2.5** Multiply the value obtained in **B-4.1.2.4** by 2.238 to determine the percentage of hydrated magnesium oxide.

**B-4.1.2.6** Subtract the percentage of hydrated magnesium oxide (**B-4.1.2.5**) from magnesium oxide in the hydrated lime (**B-4.1.2**) to obtain the percentage of unhydrated magnesium oxide.

**B-4.1.2.7** Compute carbon dioxide to calcium carbonate by multiplying by 2.27.

**B-4.1.2.8** The sum of free lime (**B-3.1.2**), calcium carbonate (**B-4.1.2.7**) magnesium oxide in hydrated lime (**B-4.1.2**) and combined water (**B-4.1.2.1**) gives the total hydrated lime.

**B-4.1.2.9** The percentage of unhydrated magnesium oxide (**B-4.1.2.6**) divided by total hydrated lime (**B-4.1.2.8**), multiplied by 100, gives the percentage of unhydrated magnesium oxide and calcium oxide in the mixture.

**B-4.1.2.10** Multiply the percentage of combined water (**B-4.1.2.1**) by 3.11 to get the percentage of hydrated calcium oxide.

**B-4.1.2.11** To determine the percentage of unhydrated calcium oxide and magnesium oxide, subtract the percentage of hydrated calcium oxide (**B-4.1.2.10**) from the sum of free lime (**B-3.1.2**) and magnesium in hydrated lime (**A-4.1.2**).

**B-4.1.2.12** The sum of free lime (**B-3.1.2**), calcium carbonate (**B-4.1.2.7**), magnesium oxide in hydrated lime (**B-4.1.2**) and combined water (**B-4.1.2.1**) gives the total hydrated lime.

**B-4.1.2.13** Divide the percentage of unhydrated calcium oxide and magnesium oxide (**B-4.1.2.11**) by total hydrated lime (**B-4.1.2.3**) to obtain the percentage of unhydrated calcium oxide and magnesium oxide in the mixture.

**B-4.1.2.14** Divide magnesium oxide in hydrated lime (**B-4.1.2**) by total hydrated lime (**B-4.1.2.8**) to obtain percentage of unhydrated calcium oxide and magnesium oxide in mixture

**B-4.1.3** Report the percentages of Portland cement, hydrated lime, etc, as obtained by above calculations

## ANNEX C

(Clause 4.1.1)

### FREEDOM FROM ORGANIC BINDERS

#### C-0 GENERAL

##### C-0.1 Outline of the Method

The material is heated in an evaporating dish and examined for any smoke and odour given out. If appreciable smoke is given out then the material is made into a coating composition, painted on a tinsplate panel and examined for adhesion.

#### C-1 APPARATUS

##### C-1.1 Evaporating Dish

##### C-1.2 Tinsplate Panel

#### C-2 PROCEDURE

**C-2.1** Place 1 to 3 g of the material in an evaporating dish and gently heat over an open flame. Examine for any smoke having oily odour. Only a trace of smoke having an oily odour should be given off. If appreciable smoke is noted, mix 25 ml of sample with 25 ml of water and let stand for 30 minutes. Stir and brush on clean tinsplate panel. Allow to dry for one hour. If the material bonds to the impervious surface, organic binder is present.

**C-2.1.1** The material shall be deemed to have passed the test, if the paint film does not bond to the impervious surface of the panel.

## ANNEX D

( Clause 4.4 )

### DETERMINATION OF DURABILITY

#### D 0 GENERAL

##### D-0.1 Outline of the Method

The durability of the material is determined by ascertaining actual behaviour of suitably prepared test panels in normal outdoor exposure test for a specified period and evaluating the results of this exposure by a suitable method of rating for various characteristics of the film.

#### D-1 TEST PANELS AND THEIR PREPARATION

**D-1.1** Panel used for all tests, unless otherwise mentioned, shall be prepared as follows.

**D-1.1.1 Concrete Panels** — of size 150 mm × 150 mm × 12.5 mm, prepared is follows:

cement (conforming to IS 269 : 1967 )	450 g
sand (conforming to IS 650 : 1966 )	900g
0.625 cm blue metal jelly	450 g
Water	180 g

Cast the mix into a mould 30 cm × 30 cm × 1.25 cm in size, suitably partitioned to give four panels. Trowel cut the top surface of the block after compacting and levelling with a wooden float, taking care that all the material remains in the mould. The blocks are allowed to harden in air for 24 hours and then cured in water for 14 days. They are ready for use after this, and shall be stored in a place free from chemical fumes.

#### D-2 PREPARATION OF PAINT FOR TESTING

**D-2.1** Using a suitable measure, take one measure of dry material and add the material to half a measure of water. To the cement paint, add small quantity of water at a time and mix thoroughly until a smooth, uniform paste is obtained. Then add another half a measure of water stirring all the while. Allow this mixture to stand for 15 minutes.

Apply this by stiff fibre brush ensuring that the application is completed within an hour.

#### D-3 PREPARATION OF PAINTED PANELS

**D-3.1** Thoroughly wet with water the concrete panels prepared by immersing in water for one hour and allow to drain until no free water remains on the surface. Apply the mixed paint by brushing with a stiff fibre brush to the top surface of the concrete panel. Place the panel in an draught and fume-free area.

**D-3.2** Apply two coats, with a minimum interval of 24 hours in between coats, keeping the panel

wet throughout this period. It is essential to keep the surface wet after the final coat for about 2 days by frequent splashing of water to get the best performance.

#### D-4 NORMAL OUTDOOR EXPOSURE TEST

**D-4.0** Subject the samples for registration to normal outdoor exposure test in the manner described in **D-4.1** to **D-4.6**.

**D-4.1** Prepare the test panels and the paint as prescribed under **D-1** and **D-2**. Three coats of the paint are applied as prescribed under **D-3**.

**D-4.2** Expose one set of panels facing east and another south, vertically. The panels are exposed for 18 months. Commence the exposure not earlier than third week of January and not later than the first week of April.

**D-4.3** Examine the conditions of the exposed films at an interval of 5 months for the following characteristics:

- a) Colour,
- b) Flaking,
- c) Cracking, and
- d) Chalking.

**D-4.3.1** For the above examination, wash the right hand half of the surface of test panels by pouring water and then wiping with soft cloth. Examine the same half of the test panels at each examination. At the end of the stipulated period for durability test, examine the two halves of the test panels for the above characteristics. The sample considered satisfactory if the condition of the film in both the halves, the one washed periodically as well as the one washed only for the final examination, is satisfactory by the method of evaluation described in **D-4.4**. Stray film failure due to extraneous causes other than climatic shall be ignored.

#### D-4.4 Method of Rating

The film of the unexposed panel shall be rated with the following basic values for the respective characteristics;

a) Possessing correct colour	25
b) Freedom from flaking (loss of adhesion and hence lifting)	25
c) Freedom from cracking	25
d) Freedom from chalking	25
	100

#### D-4.5 Evaluation of Exposed Films

In recording the condition of exposed films at each examination; express the observed relative values of different characteristics in percentages

of the basic value allotted to each characteristic under D-4.4. The allotment of performance value should be multiples of 10. For arriving at an assessment multiply the basic value for each characteristic (see D-4.4) by the percentage awarded for the performance in the test and divide the product so obtained by 100 to obtain the percentage award for the observed value of each characteristic. Take the sum total of these resulting values as the overall assessment.

**D-4.5.1** The following table is intended to serve as an example for the assessment of a cement paint film after exposure:

Characteristic (1)	Basic Value (2)	Performance Value (3)	Assessment Value (4)
a) Possessing coned colour	25	70	17.50
b) Freedom from flaking (loss of adhesion and hence lifting)	25	70	17.50
c) Freedom from cracking	25	60	15.00
d) Freedom from chalking	25	10	2.50
			52.50

#### D-4.6 Result of Exposure

Reckon the period for general breakdown of the exposed film from the date of commencement of exposure to the time when the overall assessment falls below 50 percent or when the performance value of any one characteristic falls below 25 percent of the basic value adopted for that characteristic. In the example given above although the overall assessment is 52.50 percent, yet the film is to be regarded as having generally broken down, because the performance value of chalking has fallen below 25 percent of its basic value.

## ANNEX E

[ Table 1, Item (i) ]

### DETERMINATION OF DRYING TIME AND RECOATING PROPERTIES

#### E-0 GENERAL

##### E-0.1 Outline of the Method

A concrete panel (D-1.1.1) is coated with the material uniformly and its drying time determined. A second coat is applied over the first coat at the end of the specified period and the ability to take the second coat is examined.

#### E-1 PROCEDURE

**E-1.1** Prepare a panel as prescribed under D-1 and apply one coat of the paint uniformly observing all

the precautions. Allow the film to air-dry noting drying time. At the end of the specified period, apply another coat of the paint and examine the ability of the paint to take the second coat.

*NOTE* — Drying time denotes time for hydration and hardening of the paint film and not for evaporation of moisture.

**E-1.2** The paint shall be deemed to have complied with the requirements of this standard, if it dries within the stipulated time and if a second coat of the same paint can be applied over the first without lifting, working, rolling up or softening it.

## ANNEX F

[Table 1, Item (v)]

### DETERMINATION OF RESIDUE ON SIEVE

#### F-0 GENERAL

##### F-0.1 Outline of the Method

The material is made into a thin paste with water and passed through a 63-micron IS Sieve.

#### F-1 PROCEDURE

**F-1.1** Weigh accurately not less than 50 g of the sample and transfer to a 250-ml beaker. Mix the material to a thin paste with water. Thoroughly mix the contents of the beaker and break up the lumps with the flattened end of a stirring rod without grading action. The test should be completed within

one hour of making the paste as otherwise the material will thicken up in the processing of setting. Then transfer the contents of the beaker to a 63-micron IS Sieve, using a wash bottle containing water. Remove with a camel-hair brush any small particles of the material which may be retained on the stirring rod or the sides of the beaker. Wash the residue left on the sieve with water and gently brush with the camel-hair brush until the water passing over the residue and through the sieve is clear and free from solid particles. When the washing is complete, dry the sieve for one hour at  $100^{\circ} \pm 2^{\circ}\text{C}$  and weigh the residue.

Calculate and express the result as percent by mass of the material taken for the test.

## ANNEX G

[ Table 1, Item (vi) ]

### DETERMINATION OF RESISTANCE TO DRY RUBBING

#### G-0 GENERAL

##### G-0.1 Outline of the Method

The painted panel is rubbed with a piece of white or black cambric cloth and compared against a registered sample tested similarly at the same time for soiling.

#### G-1 PROCEDURE

**G-1.1** Prepare the panel as prescribed under **D-1.1.1** and apply two coats of paint as

prescribed under **D-3**. Allow the panel to cure for 24 hours after second coating. Rub the film with a piece of white or black soft cambric cloth according to the colour of the material. Carry out the test under similar conditions and at same time on a registered sample.

**G-1.2** The material shall be deemed to have passed the test if the test cloth is not soiled by the film prepared from the material to a greater extent than that prepared from the registered sample when both are tested by the same person in the same manner at the same time.

**ANNEX H**[ *Table 1, Item (vii)* ]**DETERMINATION OF WATER REPELLANCY****H-0 GENERAL****H-0.1 Outline of the Method**

The painted film is subject to a spray of water for one hour and the amount of water absorbed is determined.

**H-1 PROCEDURE**

**H-1.1** Prepare a concrete panel of size 450 mm × 350 mm and condition it for 48 hours at room temperature. Apply two coats of the material at an interval of 24 h and wetting inbetween the coats.

After second coat, allow to cure for 7 days ( by keeping the panel moist during these days ). Seal the edges and back of the panel with wax and weigh the panels. Keep the panel inclined at an angle of 30° to 45° and allow 135 litres of water to be sprayed at a constant rate for one hour at the central area of the panel, through a nozzle placed 60 cm away and 60 cm above the panel. At the end of the stipulated period remove the panel. Carefully drain away all the surface water and determine its mass.

**H-1.2** The material shall be taken to have passed the test if the water absorbed by the concrete panel is not more than 200 g/m<sup>2</sup>.

**ANNEX J**[ *Table 1, Item (viii)* ]**DETERMINATION OF POT LIFE OF MIXED PAINT****J-1 PROCEDURE**

**J-1.1** Prepare a mix of the material as prescribed under **D-2** and allow it to stand for one hour. At the end of this period, examine the mix for any settling.

**H-1.2** The material shall be deemed to have passed the test if the degree of settling of the mix is not such as to affect the easy application of the material.

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