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(उपभोक्ता मामले, खाद्य एवं सार्वजनिक वितरण मंत्रालय, भारत सरकार)
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व्यापक परिचालन मसौदा

हमारा संदर्भ : सीईडी 05/टी-25 **08 अगस्त 2025**

तकनीकी समिति : फर्श, दीवार फिनिशिंग और छत विषय समिति, सीईडी 05

प्राप्तकर्ता :

क) सिविल अभियांत्रिकी विभाग परिषद, सीईडीसी के सभी सदस्य
ख) सीईडी 05 के सभी सदस्य
ग) रुचि रखने वाले अन्य निकाय।

महोदय/महोदया,

निम्नलिखित भारतीय मानक का मसौदा संलग्न है:

प्रालेख संख्या	शीर्षक
सीईडी 0(27984) WC	**रासायनिक प्रतिरोधी मोर्टार — परीक्षण पद्धति भाग 2 सल्फर प्रकार का भारतीय मानक मसौदा** [IS 4456 (भाग 2) का *पहला पुनरीक्षण*], आई सी एस 91.100.10

कृपया इस मसौदे का अवलोकन करें और अपनी सम्मतियाँ यह बताते हुए भेजे कि यह मसौदा प्रकाशित हो तो इन पर अमल करने में आपको व्यवसाय अथवा कारोबार में क्या कठिनाइयां आ सकती हैं।

सम्मतियाँ भेजने की अंतिम तिथि : 21 सितम्बर 2025

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धन्यवाद।

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ह/-
द्वैपायन भद्र
(वैज्ञानिक 'ई' एवं प्रमुख)
(सिविल अभियांत्रिकी विभाग)

सलंग्न: उपरिलिखित

भारतीय मानक ब्यूरो
(उपभोक्ता मामले, खाद्य एवं सार्वजनिक वितरण मंत्रालय, भारत सरकार)
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WIDE CIRCULATION DRAFT

Our Reference: CED 05/T-25 **08 August 2025**

Technical Committee: Flooring, Wall Finishing and Roofing Sectional Committee, CED 05

ADDRESSED TO:

1. All Members of Civil Engineering Division Council, CEDC
2. All Members of CED 05
3. All others interested.

Dear Sir/ Madam,

Please find enclosed the following draft:

Doc No.	Title
CED 05 (27984) WC	**Draft Indian Standard** **Chemical Resistant Mortars — Methods of test** **Part 2 Sulphur type** [*First revision* of IS 4456 (Part 2)], ICS 91.100.10

Kindly examine the attached draft and forward your views stating any difficulties which you are likely to experience in your business or profession, if this is finally adopted as National Standard.

Last Date for Comments: 21 September 2025

Comments if any, may please be made in the enclosed format and emailed at ced5@bis.gov.in or sent at the above address. Additionally, comments may be sent online through the BIS e-governance portal, www.manakonline.in.

In case no comments are received or comments received are of editorial nature, kindly permit us to presume your approval for the above document as finalized. However, in case comments, technical in nature are received, then it may be finalized either in consultation with the Chairman, Sectional Committee or referred to the Sectional Committee for further necessary action if so desired by the Chairman, Sectional Committee.

The document is also hosted on BIS website www.bis.gov.in.

Thanking you,

Yours faithfully,
Sd/-

Dwaipayan Bhadra
(Scientist 'E' and Head)
(Civil Engineering Dept.)

Encl: As above

FORMAT FOR SENDING COMMENTS ON BIS DOCUMENTS

(Please use A-4 size sheet of paper only and type within fields indicated. Comments on each clause/sub-clause/table/fig etc. be started on a fresh box. Information in column 3 should include reasons for the comments and suggestions for modified working of the clauses when the existing text is found not acceptable. Adherence to this format facilitates Secretariat's work). {Please e-mail your comments to ced5@bis.gov.in}

Doc. No.: **CED 05 (27984) WC**

Title: **CHEMICAL RESISTANT MORTARS — METHODS OF TEST**
PART 2 SULPHUR TYPE
(*First revision* of IS 4456 Part 2), ICS 91.100.10

LAST DATE OF COMMENTS: **21 September 2025**

NAME OF THE COMMENTATOR/ORGANIZATION: _____

Sl. No.	Clause/Sub-clause/Para No.	Comments/Suggestions	Modified Wordings	Reasons/Justifications for the Proposed Changes
(1)	(2)	(3)	(4)	(5)

NOTE – Kindly insert more rows as necessary for each clause/table, etc.

BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENTS ONLY

Draft Indian Standard

CHEMICAL RESISTANT MORTARS — METHODS OF TEST PART 2 SULPHUR TYPE

[*First revision* of IS 4456 (Part 2)]

ICS 91.100.10

Flooring, Wall Finishing and Roofing Sectional Committee CED 05	Last date for Comment: **21 September 2025**

FOREWORD

(Formal clauses will be added later)

This standard which covers the methods of test for the determination of various characteristics of sulphur type chemical resistant mortar is an essential adjunct to the 'Indian Standard specification for chemical resistant mortars: Part III Sulphur type'.

This standard was first published in 1967. The present revision has been taken up mainly to incorporate the modifications necessary as a result of experience gained by the industry in the manufacture and application of such type of mortars. In this revision, a clause has been added to address test method for the specimen when it is to be tested for exposure of the mortar to more than one acid.

In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country. This has been met by referring to the following publications:

a) C 267-20 Standard Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacings and Polymer Concretes.
b) C 287-98 Standard Specification for Chemical-Resistant Sulfur Mortar.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 2022 'Rules for rounding off numerical values (second revision)'.

Draft Indian Standard

CHEMICAL RESISTANT MORTARS — METHODS OF TEST
PART 2 SULPHUR TYPE
(*First revision* of IS 4456 Part 2)

1 SCOPE

This standard covers the methods for carrying out the following tests on sulphur type chemical resistant mortar:

	Method of Test	*Clause of Numbers*
a)	Compressive strength	3
b)	Tensile strength	4
c)	Flexural strength	5
d)	Bond strength	6
e)	Resistance to thermal shock	7
f)	Moisture absorption	8
g)	Sulphur content	9
h)	Tendency of aggregate to settle	10
j)	Chemical resistance	11

2 REFERENCES

The standard listed below contain provisions, which through reference in this text constitute the provision of this standard. At the time of publication, the edition indicated was valid. The standard is subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of this standard:

IS No	*Title*
IS 4456 (Part 1) : 1967	Methods of test for chemical resistant mortars: Part 1 silicate type and resin type (*under revision* Doc. No. CED 05 (27587)

3 COMPRESSIVE STRENGTH

3.1 Object

To determine the compressive strength of sulphur type chemical resistant mortar.

3.2 Apparatus

3.2.1 *Balance* — of capacity 1 kg, sensitive to 0.1 g.

3.2.2 *Moulds* — The moulds shall be made of hard metal not attacked by the mortar and shall be of the type capable of making three 50 mm cubes at one time. These shall be tight fitting and shall be separable into not more than two parts. The parts of the moulds when assembled shall be positively held together. The sides of the moulds shall be

sufficiently rigid to prevent spreading or warping. The interior faces of the moulds shall be plane surfaces. The angle between adjacent interior faces and between interior faces and top and bottom planes of the mould shall be 90° ± 0.5 °C measured at points slightly removed from the intersection of the faces. A brass base plate and cover plate attached with studs and wingnuts shall be used. Two 10 mm holes shall be provided in the cover plate for pouring.

3.2.3 *Compression Testing Machine*

3.3 Preparation of Mortar

About 2.5 kg of the sample of sulphur mortar shall be melted in not more than one hour and held at a temperature of 130° to 140 °C for at least 15 minutes while being stirred to lift the aggregates without beating air into the melt. All test specimens shall be cast from this sample.

3.4 Moulding Test Specimenss

3.4.1 Cast six 50 mm cube specimens.

3.4.2 The mould and plates shall be greased before assembly. Melt the sample as described in **3.3**. Fill the mould up to 5 mm from the top with sulphur mortar at 130° to 140 °C. Fill in shrinkage hole as it forms. Place the cover plate on top of the mould and fill the remainder of the mould with sulphur mortar through the 10 mm holes. Use a small funnel in the pouring so that shrinkage will take place in the funnel. Allow the specimen to remain in the mould until it is completely solidified. Upon removal, file or grind the surface flush removing the excess material remaining at the pouring gate.

3.5 Conditioning Test Specimens

Remove the specimens from the moulds as soon as the mortar has solidified. Age the specimens for 48 h in air at 27° ± 2 °C, the 48 h to include the time in the mould.

3.6 Procedure

The cubes shall be tested on their sides without any packing between the cubes and the steel plattens of the testing machine. Place the test specimens in the testing machine in such a manner that the faces of the cube that were in contact with the two plain surfaces of the mould are placed in contact with the steel plattens of the testing machine. One of the plattens shall be carried on a base and shall be self-adjusting, and the load shall be steadily and uniformly applied, starting from zero at a rate of 200 kg/cm^2/min. Record the total maximum load indicated by the testing machine.

3.7 Calculation

Calculate the compressive strength from the crushing load and the average area over which the load is applied.

> NOTE — Cubes that are manifestly faulty shall not be considered. If any of the individual strength values of the specimens made from the same sample and tested differ by more than 15 percent from the average strength or if fewer than four strength values were used in deriving the average strength, the test shall be repeated.

3.8 Report

The average compressive strength value shall be reported in kg/cm^2.

4 TENSILE STRENGTH

4.1 Object

To determine the tensile strength of sulphur type chemical resistant mortar.

4.2 Apparatus

4.2.1 *Balance* — of capacity 1 kg, sensitive to 0.1 g.

4.2.2 *Moulds* — The moulds shall be capable of producing briquettes of the shape shown in Fig. 2 of IS 4456 (Part 1).

4.2.3 *Testing Machine* — The universal type testing machine in which load is applied at constant but adjustable rate.

4.3 Preparation of Mortar

Mortar shall be prepared as described in **3.3**.

4.4 Moulding Test Specimens

4.4.1 Cover the waist of the mould with a small lubricated plate having the edges next to the mould rounded off to a radius of approximately 3 mm. Melt the sample in accordance with the procedure described in **3.3**. Pour the molten sulphur mortar into both sides of the mould and puddle it to fill the space under the plate completely. Allow the plate across the centre of the mould to remain in place for at least 15 minutes after the briquette has been poured.

4.4.2 Cast six briquette test specimens.

4.5 Conditioning of Test Specimens

Conditioning shall be done as described in **3.5**.

4.6 Procedure

Remove all rough edges from the surface of the briquette that has to come in contact with the tensile testing machine. The specimens shall be placed and carefully centered in strong metal jaw of the shape shown in Fig. 3 of IS 4456 (Part 1).

> NOTE — In order to distribute the stress set by the pressure of the jaws over as large a surface of the briquettes as possible, it is recommended that rubber or greased paper be inserted between the sides of the briquette and the jaws of the machine.

4.7 Faulty Briquettes and Retests

4.7.1 Briquettes which upon removal from the moulds at the end of the first 24 hour period after gauging do not conform to the requirements for width at the waist line and thickness, or which are manifestly faulty, shall be rejected. If, after such rejection, the number of briquettes left over is insufficient for four tests, fresh gauging shall be done.

4.7.2 In calculating the average value of the test results at any period, strength values differing by more than 15 percent from the average shall be discarded. After discarding such values, if less than four strength values are left for determining the tensile strength, the test shall be repeated.

4.8 Report

The tensile strength in kg/cm^2 shall be reported as the average of six test results.

5 FLEXURAL STRENGTH

The sulphur mortar shall be melted as given in **3.3** and the molten sulphur is poured into moulds permitting the moulding of bars of dimension 25 mm × 25 mm × 250 mm. The test specimens shall remain in their respective moulds for a period of 48 h for aging. At least six test specimens shall be tested. The test shall be carried out and completed in accordance with the method laid down in **7.4**, **7.5** and **7.6** of IS 4456 (Part 1).

6 BOND STRENGTH

The sulphur mortars shall be melted as given in **3.3**. The tiles shall be mounted in a special jig as shown in Fig. 1. Molten mortar shall be poured into the joint cavity provided by the assembly. At least 15 minutes shall be allowed for the mortar to set before handling the specimen. The test shall be carried out in the same manner as described in **9** of IS 4456 (Part 1).

7 RESISTANCE TO THERMAL SHOCK

7.1 Object

To determine the proportion of original strength retained by the sulphur mortar after thermal shock.

7.2 Apparatus

7.2.1 *Balance* — of capacity 1 kg, sensitive to 0.1 g.

7.2.2 *Moulds* — The moulds shall be of the form given in **4.2.2**.

7.2.3 *Testing Machine* – The universal type testing machine in which the load is applied at constant but adjustable rate.

7.2.4 Two drums each of 50 litres capacity with suitable arrangements for heating to about 85 °C.

7.3 Procedure

Cast at least 10 briquettes according to the method given at **4.4.1** and store them for 48 h in air at 27° ± 2 °C. Determine the tensile strength of 5 briquettes according to the procedure laid down in **4.6**. Two drums shall be provided each containing 45 litres of water. Maintain the temperature in one drum between 80° – 85 °C. Place the remaining five briquette specimens in a wire cage constructed so as to hold the briquettes spaced at least 25 mm from each other. Suspend the specimens in the middle of the hot bath for

5 min and immediately transfer to the cold bath for 5 min. After five cycles remove the 5 briquettes and determine their tensile strength as described in **4.6**.

7.4 Calculation

Calculate percentage original strength retained from the following formula:

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

where

A = average tensile strength in kg/cm^2 before thermal shock treatment,

B = average tensile strength in kg/cm^2 after thermal shock treatment, and

C = percent strength retention after thermal shock treatment.

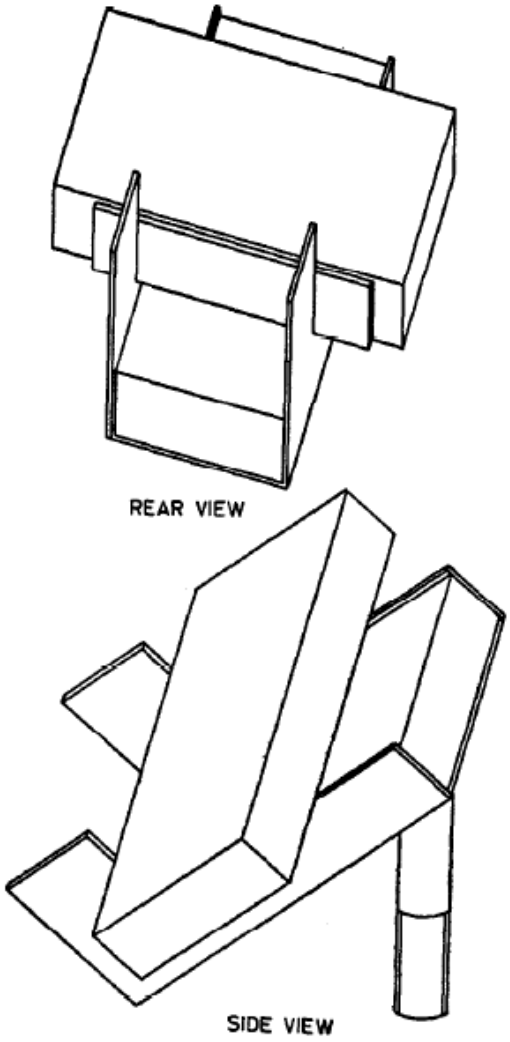

FIG. 1 APPARATUS FOR PREPARATION OF MORTAR JOINT BY CASTING

7.5 Report

The resistance to thermal shock shall be reported as the percentage strength retained after the thermal shock treatment.

8 MOISTURE ABSORPTION

8.1 Object

To determine the percentage moisture absorption of sulphur type chemical resistant mortars.

8.2 Test Specimens

Cast three 50 mm cubes as described in **3.4**.

8.3 Conditioning of Test Specimens

Age the specimens for 48 h in air at 27° $\pm$ 2 °C, the 48 h to include the time in the mould.

8.4 Procedure

Immediately after conditioning weigh the specimens. Suspend the specimens in water at 85 °C for five h. Remove the specimens, wipe off the surface water with a damp cloth and weigh. Weighing shall be completed within five minutes after removal from the bath.

8.5 Calculation

Calculate the absorption of each of the specimens as follows:

$$\text{Percentage absorption} = \frac{(W_2 - W_1)}{W_1} \times 100$$

where

W_1 = dry weight of specimens, and

W_2 = saturated weight of specimens after five h of submersion in water at 85 °C.

8.6 Report

The average percentage moisture absorption shall be reported.

9 SULPHUR CONTENT

9.1 Object

To determine the sulphur content in sulphur type chemical resistant mortars.

9.2 Apparatus

Extraction apparatus as shown in Fig. 2.

9.3 Procedure

Dry and weigh a Whatman filter thimble and place 10 g to 15 g of the specimen in the thimble and pour 40 ml to 50 ml of carbondisulphide over the specimen. Suspend the thimble containing specimen under the condenser by a fine wire bail as shown in Fig. 2. Carefully heat the flask in a water bath just enough to vaporise the solvent while circulating cold water through the condenser. Continue the extraction until the carbondisulphide has filled the filter thimble and siphoned over 20 times. To determine whether the extraction is complete, remove the filter and wash with a fine jet of carbondisulphide from a wash bottle. Collect the washings and evaporate to dryness on a water bath. If any residue remains, replace the filter and continue the extraction until the filtrate leaves no residue on evaporation.

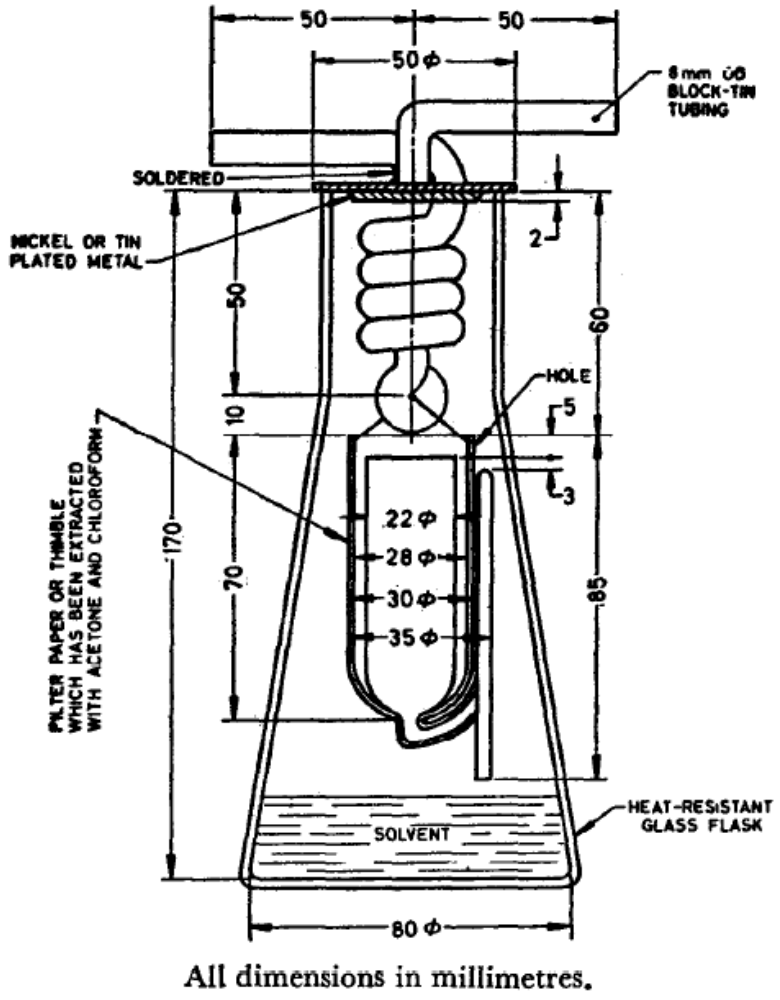

FIG. 2 EXTRACTION APPARATUS FOR DETERMINATION OF SULPHUR CONTENT

9.3.1 Remove the filter. At first carefully dry at a low temperature to prevent ignition of carbondisulphide and next at 100 °C to constant weight. Loss of weight represents the sulphur content of the, specimen. Distil the carbondisulphide from the residue after extraction of the sulphur and weigh the residue as a check on the sulphur content.

NOTE — Carbondisulphide is toxic and has a flash point of 4 °C.

9.4 Report

The percentage sulphur content of the mortar shall be reported.

10 TENDENCY OF AGGREGATE TO SETTLE

10.1 Object

To evaluate the tendency of the aggregate in the sulphur mortar to settle.

10.2 Apparatus

10.2.1 *Glass Tube* — Heat resistant type, 25 mm diameter and 200 mm long.

10.3 Procedure

Fill the glass tube with molten sulphur mortar and hold it at a temperature of 140 °C for 30 min. Carefully remove the test tube, hold under warm water until congealing begins and then immerse in ice water. When the sulphur mortar has solidified, break the tube, extract the top and bottom thirds of the contents separately by the method given in **9.3**. Calculate the sulphur content and the aggregate content of each of the two portions. The aggregate content of the bottom portion divided by that of the top portion is an index of the tendency of the aggregate to settle.

NOTE — For a coarse silica aggregate that settles rapidly the index is greater than unity while for a coke aggregate that floats, it is less than unity.

10.4 Report

The index which gives the tendency of the aggregate to settle shall be reported.

11 CHEMICAL RESISTANCE

11.1 Object

To evaluate the chemical resistance of sulphur type chemical resistant mortars under anticipated service conditions.

11.2 Preparation of Specimens

Melt about 1 kg of the sulphur mortar in a suitable container in not over 1 hour and hold at a temperature of 130° to 140 °C for at least 15 minutes with constant agitation. The stirring shall be such as to lift the aggregate without beating air into the melt. Place the piece of plastic sheet containing the rectangular hole, bevelled side down, over the open face of the mould with the hole centred on the face. On top of the piece of plastic sheet and surrounding the rectangular hole place a section of plastic tubing or pipe 25 mm in diameter by 25 mm high. Pour the melted mortar through the rectangular hole into the mould, and continue to pour until the section of tubing or pipe is completely filled. The excess of mortar contained in the section of tubing or pipe acts as a reservoir to compensate for shrinkage of the mortar during cooling. Allow the specimen to remain in the mould until it has completely solidified. Upon removal file, grind or sand off the surface flush, removing the excess material remaining at the pouring gate.

11.3 Conditioning the Test Specimens

Age the specimens for 48 h in air at 27° ± 2 °C, the 48 h to include the time in the mould.

11.4 Testing

11.4.1 *Procedure for Rapid Test in evaluating the chemical resistance to acids (This method is intended for use as a relatively rapid test in evaluating the chemical resistance to acids).*

This test is a measure to relatively identify the resistance of the mortar for exposure to one or more acids. When it is desired to conduct a chemical resistance test for silicate or resin type mortar for simultaneous exposure to more than one acid, the following process shall be adopted:

a) Six samples of mortar shall be prepared for each test as per method explained in respective test as described in **11.2**.

b) These samples shall be first immersed in 20 percent (by weight) solution of HCl, and change in properties (if any) as mentioned in its test procedure shall be noted.

c) The same samples shall then be immersed in 20 percent (by weight) solution of H_2SO_4, and change in properties (if any) as mentioned in its test procedure, over and above the changes in properties if happened during immersion in HCl solution; shall be noted.

d) Finally, these samples shall be then immersed in 20 percent (by weight) solution of HNO_3 and change in properties (if any) as mentioned in its test procedure, over and above the changes in properties if happened during immersion in HCl and H_2SO_4 solutions; shall be noted.

> NOTE — In cases where there is change in property after 1st or 2nd operation as mentioned in **11.4.1** (b) and **11.4.1** (c) the initial sample maybe immersed separately in H_2SO_4 or HNO_3, that is second or third type of acid to assess their reactivity respectively in the individual acids.

e) The acid(s) through which the samples have not changed their properties are those chemicals that are resisted in ‘good’ category by the mortar.

f) The acid(s) through which the samples have changed only their colour and not any other property are those chemicals that are resisted in ‘fair’ category by the mortar.

g) The acid(s) through which the samples have changed their colour as well as developed granular texture on skin of samples are those chemicals that are resisted in ‘poor’ category by the mortar.

h) The acid(s) through which the samples have lost their weight are those chemicals that are not resisted by the mortar.

11.4.2 The test shall be carried out and completed in accordance with the method described in **11.10**, **11.11**, **11.12**, **11.13** and **11.14** of IS 4456 (Part 1).