

इंटरनेट

मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“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 14959-2 (2001): Method of Test determination of water soluble and acid soluble chlorides in mortar and concrete, Part 2: Hardened mortar and concrete [CED 2: Cement and Concrete]



“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”

BLANK PAGE



REAFFIRMED 2011
IS 14959 (Part 2) : 2001

भारतीय मानक
मोर्टार व कांक्रीट में जल एवं अम्ल में
घुलनशील क्लोराइड का निर्धारण — परीक्षण पद्धति
भाग 2 कठोर मोर्टार व कांक्रीट

Indian Standard

DETERMINATION OF WATER SOLUBLE AND
ACID SOLUBLE CHLORIDES IN MORTAR AND
CONCRETE — METHOD OF TEST

PART 2 HARDENED MORTAR AND CONCRETE

ICS 91.100.10;100.30

© BIS 2001

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

August 2001

Price Group 3

AMENDMENT NO. 1 AUGUST 2007
TO
IS 14959 (PART 2) : 2001 DETERMINATION OF WATER
SOLUBLE AND ACID SOLUBLE CHLORIDES IN
MORTAR AND CONCRETE — METHOD OF TEST

PART 2 HARDENED MORTAR AND CONCRETE

(Page 1, clause 4.1.6, line 1) — Insert 'dried at 160°C and cooled in a desiccator' after 'silver nitrate'.

(Page 2, clause 4.1.6, last line) — Add at the end 'and record the exact normality of the silver nitrate solution'.

(Page 2, clause 4.1.7, first line) — Substitute '1.52 g' for '1.7 g'.

(Page 2, clause 4.1.7, last line) — Add at the end 'or record the exact normality'.

(Page 2, clause 4.1.7) — Add the following note at the end:

'NOTE — Sometimes it is difficult to make exactly 0.02 N solution if the standard normality of the solution is less'.

(Page 2, clause 4.3.1.2, line 3) — Insert 'or more' after '25 ml' and substitute '0.02 N' for '0.2 N'.

(Page 2, clause 4.3.2.2, line 2) — Delete 'Add 5 ml of 6 N nitric acid.'

(Page 2, clause 4.3.2.2, line 3) — Substitute 'or more of 0.02 N' for 'of 0.2N'.

(Page 2, clause 4.4, lines 3 to 7) — Substitute the following for the existing formula:

$$\text{Chloride, percent} = \frac{2 \times 0.709 (X-Y)}{m}$$

where

X = volume of 0.02 N silver nitrate added, in ml;

Y = volume of 0.02 N ammonium thiocyanate consumed, and

m = mass of concrete sample taken for test, in g.

(CED 2)

FOREWORD

This Indian Standard (Part 2) was adopted by the Bureau of Indian Standards, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

Chlorides in the concrete could be drawn from different sources like aggregates, mix water, admixtures and cement and could lead to durability problems namely, corrosion of reinforcing steel in concrete, if present in sufficient quantity. Chlorides could be present in different degrees of binding in the concrete matrix and could be determined as water soluble and acid soluble chlorides. In some cases of corrosion of carbonated concrete, the combined chlorides (water soluble and as acid soluble) will be let free in pore water and these chlorides are harmful to concrete. To minimize the chances of deterioration of concrete due to harmful chlorides, the level of these chlorides has been limited in various design codes. Therefore, this standard has been formulated to provide necessary guidance for determination of water soluble and acid soluble chlorides in concrete. This Part 2 of the standard covers volumetric method of test for determination of chlorides in hardened mortar and concrete and Part 1 of this standard covers the method of test for fresh mortar and concrete.

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

In reporting the results 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 : 1960 'Rules for rounding off numerical values (revised)'.

Indian Standard

DETERMINATION OF WATER SOLUBLE AND ACID SOLUBLE CHLORIDES IN MORTAR AND CONCRETE — METHOD OF TEST

PART 2 HARDENED MORTAR AND CONCRETE

1 SCOPE

This standard (Part 2) covers volumetric method of test for determination of water soluble and acid soluble chlorides in hardened mortar and concrete.

NOTE — The source of samples for test in accordance with this standard may be either the stationary samples obtained from project sites or ready-mixed concrete plants.

2 REFERENCES

The Indian Standards listed below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
1070 : 1992	Reagent grade water — Specification (<i>third revision</i>)
3025 (Part 32) : 1988	Methods of sampling and test (physical and chemical) for water and wastewater : Part 32 Chloride (<i>first revision</i>)

3 SAMPLING

The apparatus required for processing the sample shall be chosen for its suitability for the purposes of the investigation. A specimen to be tested for the determination of chlorides both acid and water soluble, shall not be removed from the structure until the concrete has become hard enough to permit removal without disturbing the bond between the mortar and the coarse aggregate. Normally concrete shall be 14 days old before the specimens are removed. Specimens that show abnormal defects or that have been damaged in removal shall not be used.

A core drill shall be used for securing cylindrical core specimens (at least 100 mm diameter). The diameter of the core should be at least 2.5 times the maximum size of the aggregates and the length of the core should be at least 95 percent of core diameter. For specimens taken perpendicular to the horizontal surface,

a short drill is satisfactory. For inclined holes, a diamond drill is satisfactory. A saw having diamond or silicon carbide cutting edge shall be used for securing beam specimens from the structures or pavement.

Samples more than 25 mm in maximum dimension shall be reduced in size by use of jaw crusher or broken into smaller pieces by hammering carefully to avoid loss of smaller pieces. Crush the particles to less than 25 mm in maximum dimensions using a rotating puck grinding apparatus or by using a disk pulverizer, operated to restrict to negligible levels the loss of fine particles. Sieve the crushed samples through 850 μ m IS Sieve. Thoroughly blend the material by transferring it from one glazed paper to another at least 10 times.

4 METHOD OF TEST

4.1 Reagents

4.1.1 Quality of Reagent

Unless otherwise specified, pure chemicals of analytical reagent grade and distilled water (*see* IS 1070) shall be used in the test.

4.1.2 Nitric Acid (HNO_3) Concentrated (*Specific Gravity 1.42*)

Prepare the solution, 6N (approximately), by diluting 38 ml of concentrated nitric acid to 100 ml with distilled water.

4.1.3 Ferric Alum [$\text{FeNH}_4(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$]

Dissolve 10 g of ferric alum in 100 ml of distilled water and add 1 ml of nitric acid.

4.1.4 Potassium Chromate (K_2CrO_4), 5 Percent Solution

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

4.1.5 Nitrobenzene ($\text{C}_6\text{H}_5\text{NO}_2$)

4.1.6 Silver Nitrate (AgNO_3) Solution, 0.02 N

Weigh 1.7 g, of silver nitrate, dissolve in distilled water and dilute to 500 ml in a volumetric flask. Standardize the silver nitrate solution against 0.02 N sodium chloride solution using potassium chromate solution as indicator

IS 14959 (Part 2) : 2001

(5 percent w/v) in accordance with the procedure given in IS 3025 (Part 32).

4.1.7 Ammonium Thiocyanate (NH_4SCN) Solution, 0.02 N

Weigh 1.7 g of ammonium thiocyanate and dissolve in one litre of distilled water in a volumetric flask. Shake well and standardize by titrating with 0.02 N silver nitrate solution using ferric alum solution as an indicator. Adjust the normality exactly to 0.02 N.

4.1.8 Sodium Chloride (NaCl), 0.02 N

Weigh 1.169 2 g of sodium chloride dried at $105 \pm 2^\circ\text{C}$, dissolve in distilled water and make up to 1 000 ml in a volumetric flask.

4.2 Use of Filter Paper

In the methods prescribed in this standard, relative numbers of Whatman filter paper only have been prescribed since these are commonly used. However, any other suitable brand of filter papers with equivalent porosity may be used.

4.3 Procedure

4.3.1 Water Soluble Chloride

4.3.1.1 Weigh $1\ 000 \pm 5$ g of the pulverized mortar or concrete sample in a 2 litre capacity beaker and add 1 000 ml of distilled water (chloride free). Stir the mixture vigorously and warm gently for 15 min. After allowing the mixture to stand for 24 h for settling, decant about 200 ml of the supernatant solution into a clean dry 250 ml capacity beaker. Immediately, filter the solution through Whatman filter paper No. 1 and collect the filtrate.

4.3.1.2 Pipette 50 ml of filtrate in a 250 ml capacity conical flask. Add 5 ml of 6 N nitric acid. Add a known volume (X), preferably 25 ml of 0.2 N silver nitrate solution. Add 1 ml ferric alum and 5 ml of nitrobenzene. Shake vigorously to coagulate the precipitate. Titrate

the excess silver nitrate with 0.2 N ammonium thiocyanate solution until a permanent faint reddish brown colour appears. Note down the volume (Y) of ammonium thiocyanate used.

4.3.2 Acid Soluble Chloride

4.3.2.1 Weigh about $1\ 000 \pm 5$ g of the pulverized mortar or concrete sample in a 2 litre capacity beaker and add 100 ml of 6N nitric acid and 900 ml of distilled water (chloride free), after stirring for few minutes. Stir the mixture vigorously and warm gently for 30 min. After allowing the mixture to stand for 10 to 15 min for settling, decant about 200 ml of the supernatant solution into a clean dry 250 ml capacity beaker. Immediately, filter the solution through Whatman filter paper No. 1 and collect the filtrate.

4.3.2.2 Pipette 50 ml of filtrate in a 250 ml capacity conical flask. Add 5 ml of 6 N nitric acid. Add a known volume (X), preferably 25 ml of 0.2 N silver nitrate solution. Add 1 ml ferric alum and 5 ml of nitrobenzene. Shake vigorously to coagulate the precipitate. Titrate the excess silver nitrate with 0.02 N ammonium thiocyanate solution until a permanent faint reddish brown colour appears. Note down the volume (Y) of ammonium thiocyanate used.

4.4 Calculation

Calculate the percentage of chloride (acid soluble/ water soluble) by mass of mortar or concrete as follows:

$$\text{Chloride, percent} = 0.00142 (X - Y)$$

where

X = volume of silver nitrate added, in ml; and

Y = volume of 0.02 N ammonium thiocyanate consumed.

NOTE – Interference of silver chloride particles (which are generated *in-situ*) in titration by reacting with thiocyanate can be avoided by the addition of nitrobenzene which forms a film on silver chloride particles.

ANNEX A*(Foreword)***COMMITTEE COMPOSITION****Cement and Concrete Sectional Committee, CED 2***Chairman***Padmashri Dr H. C. VISVESVARAYA****'Chandrika', at 15th Cross, 63-64 East Park Road,
Malleswaram, Bangalore 560003***Members**Representing*

DR S. C. AHLUWALIA	OCL India Ltd, New Delhi
DR S. S. AMETA SHRI D. K. RAI (Alternate)	Geological Survey of India, Kolkata
SHRI V. BALASUBRAMANIAN SHRI R. P. SINGH (Alternate)	Directorate General of Supplies and Disposals, New Delhi
SHRI G. R. BHARITKAR	B.G. Shirke Construction Technology Ltd, Pune
SHRI C. C. BHATTACHARYA SHRI I. K. PANDEY (Alternate)	Ministry of Surface Transport, Department of Surface Transport (Roads Wing), New Delhi
SHRI A. K. CHADHA SHRI J. R. SIL (Alternate)	Hindustan Prefab Ltd, New Delhi
CHIEF ENGINEER (DESIGN) SUPERINTENDING ENGINEER (S & S) (Alternate)	Central Public Works Department, New Delhi
CHIEF ENGINEER (NAVGAM DAM) SUPERINTENDING ENGINEER (QCC) (Alternate)	Sardar Sarovar Narmada Nigam Ltd, Gandhinagar
CHIEF ENGINEER (RESEARCH)-CUM-DIRECTOR RESEARCH OFFICER (CONCRETE TECHNOLOGY) (Alternate)	Irrigation and Power Research Institute, Amritsar
SHRI J. P. DESAI SHRI B. K. JAGTIA (Alternate)	Gujarat Ambuja Cements Ltd, Ahmedabad
DIRECTOR	Structural Engineering Research Centre (CSIR), Ghaziabad
DIRECTOR JOINT DIRECTOR (Alternate)	A.P. Engineering Research Laboratories, Hyderabad
DIRECTOR SHRI P. L. KASHYAP (Alternate)	Central Soil and Materials Research Station, New Delhi
DIRECTOR (CMDD) (N & W) DEPUTY DIRECTOR (CMDD) (NW&S) (Alternate)	Central Water Commission, New Delhi
SHRI K. H. GANGWAL SHRI V. PATTABHI (Alternate)	Hyderabad Industries Ltd, Hyderabad
GENERAL MANAGER SENIOR MANAGER (ENGINEERING) (Alternate)	Gannon Dunkerley and Company Ltd, Mumbai
DR ASHOK KUMAR GHOSH	Indian Institute of Technology, Kharagpur
SHRI S. GOPINATH SHRI R. ARUNACHALAM (Alternate)	The India Cements Ltd, Chennai
SHRI C. JAYARAMAN SHRI A. K. JAIN (Alternate)	Grasim Industries Ltd, Mumbai

(Continued on page 4)

IS 14959 (Part 2) : 2001

(Continued from page 3)

<i>Members</i>	<i>Representing</i>
SHRI S. S. GOYALIYA SHRI V. K. GOEL (<i>Alternate</i>)	Cement Corporation of India Ltd, New Delhi
JOINT DIRECTOR (STANDARDS) (B&S) (CB-I) JOINT DIRECTOR (STANDARDS) (B&S) (CB-II) (<i>Alternate</i>)	Research, Designs and Standards Organization (Ministry of .Railways), Lucknow
SHRI D. K. KANUNGO SHRI B. R. MEENA (<i>Alternate</i>)	National Test House, Kolkata
MEMBER-SECRETARY DIRECTOR (CIVIL) (<i>Alternate</i>)	Central Board of Irrigation and Power, New Delhi
SHRI P. R. C. NAIR SHRI P. D. KELKAR (<i>Alternate</i>)	The Indian Hume Pipe Company Ltd, Mumbai
DR R. NARAYANAN SHRI S. GOPALKRISHNAN (<i>Alternate</i>)	Structural Engineering Research Centre (CSIR), Chennai
DR C. RAJKUMAR DR K. MOHAN (<i>Alternate</i>)	National Council for Cement and Building Materials, Ballabgarh
SHRI S. A. REDDI	Gammon India Ltd, Mumbai
SHRI J. SARUP SHRI P. K. JAIPURIAR (<i>Alternate</i>)	Hospital Services Consultancy Corporation (India) Ltd, New Delhi
SECRETARY	Builder's Association of India, Mumbai
SHRI S. S. SEEHRA SHRI SATANDER KUMAR (<i>Alternate</i>)	Central Road Research Institute (CSIR), New Delhi
SHRI S. S. SEEHRA SHRI A. K. SHARMA (<i>Alternate</i>)	Indian Roads Congress, New Delhi
BRIG R. R. SINGH SHRI MAHENDRA PRASAD (<i>Alternate</i>)	Engineer-in-Chief's Branch, Army Headquarters, New Delhi
SUPERINTENDING ENGINEER (DESIGN) EXECUTIVE ENGINEER (<i>Alternate</i>)	Public Works Department, Government of Tamil Nadu, Chennai
SHRI C. R. V. SUBRAMANIAM SHRI S. CHOWDHURY (<i>Alternate</i>)	Larsen and Tubro Ltd, Mumbai
SHRI V. SURESH SHRI S. K. TANEJA (<i>Alternate</i>)	Housing and Urban Development Corporation Ltd, New Delhi
SHRI T. N. TIWARI DR D. GHOSH (<i>Alternate</i>)	The Associated Cement Companies Ltd, Mumbai
DR C. L. VERMA DR B. K. RAO (<i>Alternate</i>)	Central Building Research Institute (CSIR), Roorkee
SHRI VIMAL KUMAR	Fly Ash Mission, Department of Science and Technology, New Delhi
DR H. C. VISVESVARAYA SHRI D. C. CHATURVEDI (<i>Alternate</i>)	The Institution of Engineers (India), Kolkata
DR C. S. VISWANATHA SHRI D. SRINIVASAN (<i>Alternate</i>)	Indian Concrete Institute, Chennai
SHRI S.K. JAIN, Director & Head (Civ Engg)	Director, General, BIS (<i>Ex-officio Member</i>)

Member-Secretary

SHRI SANJAY PANT
Deputy Director (Civ Engg), BIS

(Continued on page 5)

(Continued from page 4)

Concrete Subcommittee, CED 2:2

<i>Convener</i>	<i>Representing</i>
DR A. K. MULLICK	Saurashtra Cements Ltd, Ahmedabad
<i>Members</i>	
SHRI C. R. ALIMCHANDANI	Stup Consultants Ltd, Mumbai
SHRI T. B. BANERJEE SHRI I. K. PANDEY (<i>Alternate</i>)	Ministry of Surface Transport (Roads Wing), New Delhi
DR D. BHATTACHARJEE	Indian Institute of Technology, New Delhi
CHIEF ENGINEER & JOINT SECRETARY SUPERINTENDING ENGINEER (<i>Alternate</i>)	Public Works Department, Government of Maharashtra, Mumbai
DR P. C. CHOWDHURY DR C. S. VISWANATHA (<i>Alternate</i>)	Tor Steel Research Foundation in India, Kolkata
SHRI KEN COWIE SHRI M. SANJAY BAHADUR (<i>Alternate</i>)	Indian Ready-Mixed Concrete Association, Bangalore
SHRI J. P. DESAI SHRI B. K. JAGETIA (<i>Alternate</i>)	Gujarat Ambuja Cements Ltd, Ahmedabad
DIRECTOR SHRI N. CHANDRASEKARAN (<i>Alternate</i>)	Central Soil and Materials Research Station, New Delhi
DIRECTOR JOINT DIRECTOR (<i>Alternate</i>)	A.P. Engineering Research Laboratories, Hyderabad
DIRECTOR (C&MDD) DEPUTY DIRECTOR (C&MDD) (<i>Alternate</i>)	Central Water Commission, New Delhi
GENERAL MANAGER SENIOR MANAGER (ENGINEERING) (<i>Alternate</i>)	Gannon Dunkerley and Co Ltd, Mumbai
DR ASHOK KUMAR GHOSH	Indian Institute of Technology, Kharagpur
SHRI J. S. HINGORANI	Associated Consulting Services, Mumbai
PROF ASHOK KUMAR JAIN	University of Roorkee, Roorkee
SHRI L. K. JAIN	In personal capacity
SHRI M. P. JAISINGH DR B. K. RAO (<i>Alternate</i>)	Central Building Research Institute (CSIR), Roorkee
JOINT DIRECTOR STANDARDS (B&S)/CB-I JOINT DIRECTOR STANDARD (B&S)/CB-II (<i>Alternate</i>)	Research, Designs and Standards Organization (Ministry of Railways), Lucknow
DR S. C. MAITI	National Council for Cement and Building Materials, Ballabgarh
DR SUDHIR MISHRA	Indian Institute of Technology, Kanpur
SHRI R. NARAYANAN SHRI K. MANI (<i>Alternate</i>)	Structural Engineering Research Centre (CSIR), Chennai
SHRI A. B. PHADKE SHRI D.M. SAVUR (<i>Alternate</i>)	The Hindustan Construction Co Ltd, Mumbai
SHRI RAM KUMAR SHRI RAJEEV GOEL (<i>Alternate</i>)	Structural Engineering Research Centre (CSIR), Ghaziabad
SHRI V. V. GOVINDA RAO SHRI R. P. GOEL (<i>Alternate</i>)	National Building and Construction Corporation Ltd, New Delhi
SHRI S. A. REDDI DR N. K. NAYAK (<i>Alternate</i>)	Gammon India Ltd, Mumbai

(Continued on page 6)

IS 14959 (Part 2) : 2001

(Continued from page 5)

<i>Members</i>	<i>Representing</i>
SHRI SUDDHODAN ROY SHRI M. KUNDU (<i>Alternate</i>)	Hindustan Prefab Limited, New Delhi
SHRI S. C. SAWHNEY SHRI R. P. MEHROTRA (<i>Alternate</i>)	Engineers India Ltd, New Delhi
SHRI S. S. SEEHRA SHRI SATANDER KUMAR (<i>Alternate</i>)	Central Road Research Institute, New Delhi
PROF M. S. SHETTY	Indian Concrete Institute, Chennai
SHRI S. N. SINGH SHRI SURINDER MOHAN (<i>Alternate</i>)	Engineer-in-Chief 's Branch, Army Headquarters, New Delhi
SHRI P. SRINIVASAN SHRI P. BANDOPADHYAY (<i>Alternate</i>)	The Associated Cement Companies Ltd, Mumbai
SUPERINTENDING ENGINEER (DESIGNS) EXECUTIVE ENGINEER (DESIGNS-III) (<i>Alternate</i>)	Central Public Works Department, New Delhi
SHRI B. T. UNWALLA	In personal capacity
SHRI U. S. P. VERMA	Nuclear Power Corporation of India Ltd, Mumbai
SHRI VIMAL KUMAR	Fly Ash Mission, Department of Science and Technology, New Delhi

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.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards : Monthly Additions'.

This Indian Standard has been developed from Doc : No. CED 2 (5816).

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 110 002
Telephones : 323 01 31, 323 33 75, 323 94 02

Telegrams: Manaksanstha
(Common to all offices)

Regional Offices :

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEW DELHI 110 002

Telephone
{ 323 76 17
{ 323 38 41

Eastern : 1/14 C. I. T. Scheme VIIM, V. I. P. Road, Kankurgachi
CALCUTTA 700 054

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

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160 022

{ 60 38 43
{ 60 20 25

Southern : C. I. T. Campus, IV Cross Road, CHENNAI 600 113

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

Western : Manakalaya, E9 MIDC, Marol, Andheri (East)
MUMBAI 400 093

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

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE.
FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR.
LUCKNOW. NAGPUR. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM.