भारतीय मानक

Indian Standard

IS 1563 : 2023

ड्रॉइंग कार्यालयों में प्रयोग के लिए चाँदा — विशिष्टि

(दूसरा पुनरीक्षण)

Protractors for Use of Drawing Offices — Specification

(Second Revision)

ICS 01.100.40

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

October 2023 **Price Group 5**

Educational Instruments and Equipment Sectional Committee, PGD 22

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Educational Instruments and Equipment Sectional Committee had been approved by the Production and General Engineering Division Council.

This standard deals with circular, semi-circular and rectangular protractors used extensively in drawing offices for checking and laying out angles for given values.

This standard is intended chiefly to cover the technical provisions relating to set squares and does not include all the necessary provisions of a contract.

This standard was first published in 1962 and subsequently revised in 1989. The second revision has been taken up to keep pace with the latest technological developments and international practices. In this revision, the following modifications have been made:

a) UDC number has been replaced by ICS number; and
b) Reference clause has been updated.

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

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. 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

PROTRACTORS FOR USE OF DRAWING OFFICES — SPECIFICAITON

(Second Revision)

1 SCOPE

This standard covers requirements for three types, namely circular, semi-circular and rectangular protractors, commonly used by cartographers, surveyors and engineers for measuring angles or laying out angles of given values, and checking angular works.

2 REFERENCES

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

IS No	*Title*
IS 2500 (Part 1) : 2000/ISO 2859-1 : 1999	Sampling procedures for inspection by attributes: Part 1 Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection (*third revision*)

3 MATERIAL

3.1 Protractors shall be made from flat sheets of transparent or opaque plastic. The recommended plastic materials are acrylic and rigid polyvinyl chloride. The plastic sheets shall be smooth, even on all sides and free from blisters, porosity and other defects.

3.2 The material shall possess toughness, hardness and flexibility sufficient to permit constant handling in use without a degree of deterioration of the surface, loss of transparency (in case of transparent plastics) or distortion such as to render it unserviceable.

3.3 The rectangular protractor shall be made of opaque plastic or metal, preferably rust-proof steel or stainless steel.

4 MANUFACTURE

4.1 Protractors shall have square or beveled edges. The opaque types shall be beveled. If beveled, the edge thickness shall not exceed 50 percent of the thickness of the sheet. Beveling of the circular edge in the case of circular and semi-circular protractors and three edges (one side and two ends) in the case of the rectangular protractors shall not exceed a width of 4 mm.

4.2 Circular and semi-circular protractors may be made from transparent or opaque plastic, while the rectangular protractors shall be made of opaque plastic or metal.

4.2.1 Circular and semi-circular protractors, if made out of plastic, shall be of open-centre pattern and those made of transparent plastic may be of solid or open-centre pattern.

4.3 The constructional details of the circular protractors of the solid and open-centre patterns are illustrated in Fig. 1 and Fig. 2 respectively.

4.4 The constructional details of the semi-circular protractors of the solid and open-centre patterns are illustrated in Fig. 3 and Fig. 4 respectively.

4.5 The constructional details of the rectangular protractors are illustrated in Fig. 5

4.6 The finish of the surface and edges of the protractors shall be smooth.

5 DIMENSIONS

5.1 Preferred sizes and thickness of the different types of protractors, their graduations and tolerances shall be as given in Table 1.

5.2 Leading dimensions in respect of the scales under **6.3.1** and their spacing from the edges or in between any two scales are illustrated in Fig. 5. The thickness of the lines shall not exceed 0.1 mm.

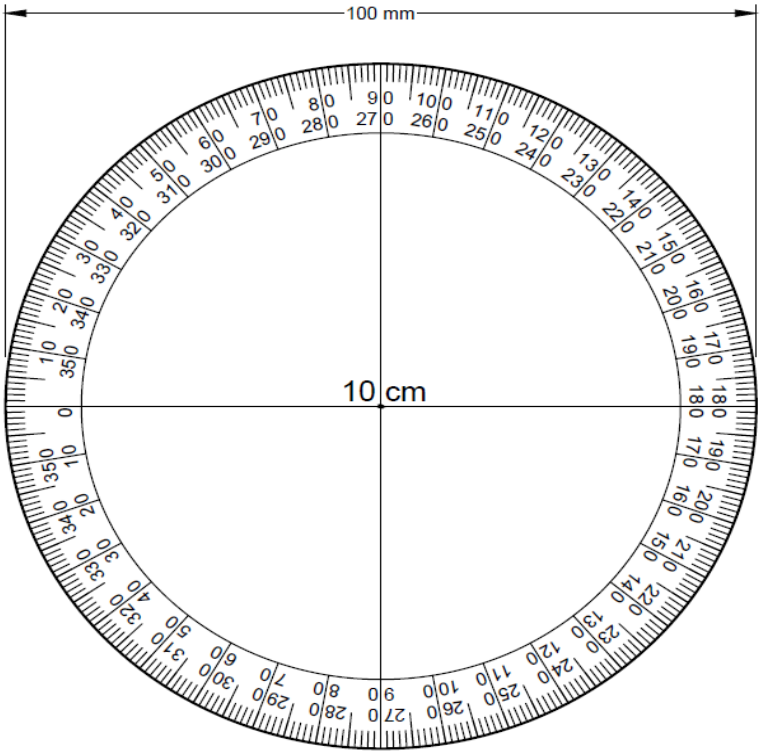


FIG. 1 CIRCULAR PROTRACTOR OF SOLID PATTERN

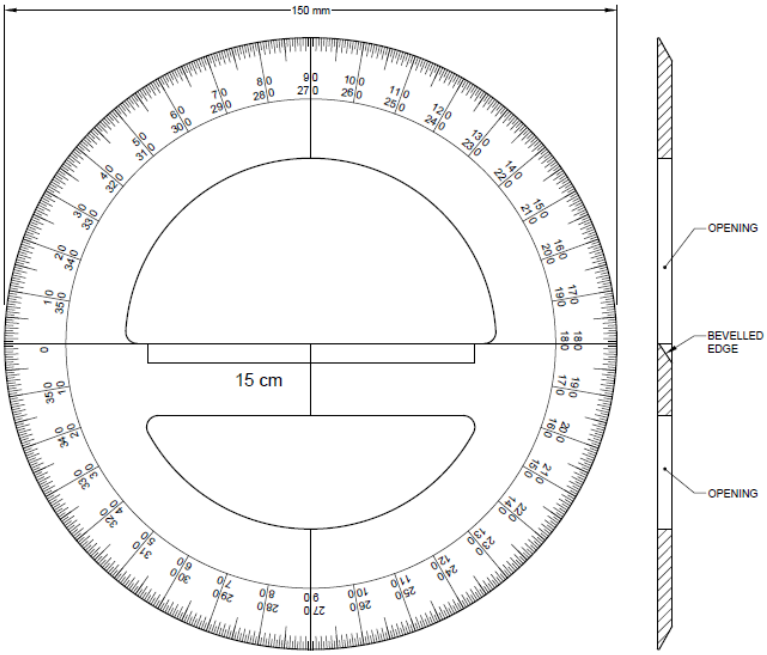


FIG. 2 CIRCULAR PROTRACTOR OF OPEN-CENTRE PATTERN

6 GRADUATIONS

6.1 All graduations shall be cut, stamped, engraved or printed on the protractors and shall be clear and fine and filled up in black so as to ensure good legibility without the use of magnifying glass.The graduation lines for 10°, 5°, 1° and 1/2° graduations shall be of different and distinctive lengths as recommended below:

Circular and semi circular protractors

10° graduation marks	15 mm	on protractor of 15 mm size and above
5° graduation marks	5 mm	
1° graduation marks	3 mm	
(1/2)° graduation Marks	2 mm	
10° graduation marks	10 mm	on protractor of 10 mm size and above
5° graduation marks	5 mm	
1° graduation marks	3 mm	

6.1.1 The circumference of the circular protractor shall be graduated on the under side for transparent protractors and on the upper side for opaque ones by radiallines of thickness 0.1 mm. The circular protractor shall be double reading and shall be figured at every 10th degree. The outer figures shall read clockwise from the horizontal line starting from left and those of the inner side shall read anti-clockwise starting from the same zero. The double numbering shall facilitate reading the angles from both ends. In the case of semi-circular and rectangular protractors, the graduations on the inner side shall start from the opposite end. The height of the figures shall be between 2.0 mm and 2.5 mm.

6.1.2 Two straight lines, one in continuation of graduations 0° to 180° and the other perpendicular to it through graduations 90° to 270°, shall be drawn completely to meet at the centre in the case of the protractors of solid pattern as illustrated in Fig. 1.

6.1.3 In the case of the protractors of open-centre pattern, a cross-bar shall cross the inner open space so that one edge of the bar shall be truly along the line joining graduations 0° and 180°. A perpendicular line which on extension shall coincide with the graduation mark of 90° or 270°, shall be marked on cross-bar to indicate the centre of the circumference.

6.2 The style and numbering of graduations on the semi-circular protractors shall be exactly similar to those specified for the circular protractors under **6.1.1**.

6.2.1 No graduations shall extend beyond the base line (which is the line joining graduation 0° and 180°) but there shall be extension of the material (not less than 6 mm) to form a straight edge beyond the base line and parallel with it.

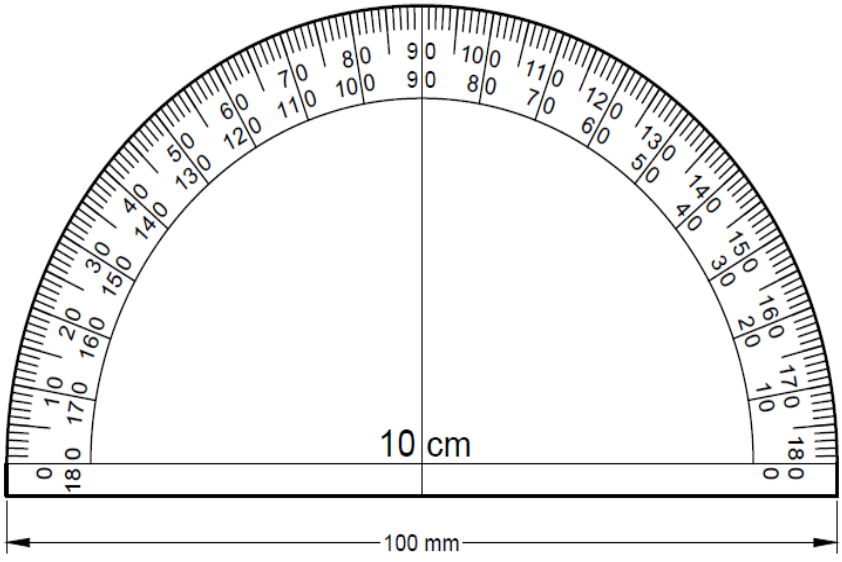


FIG. 3 SEMI-CIRCULAR PROTRACTOR OF SOLID PATTERN

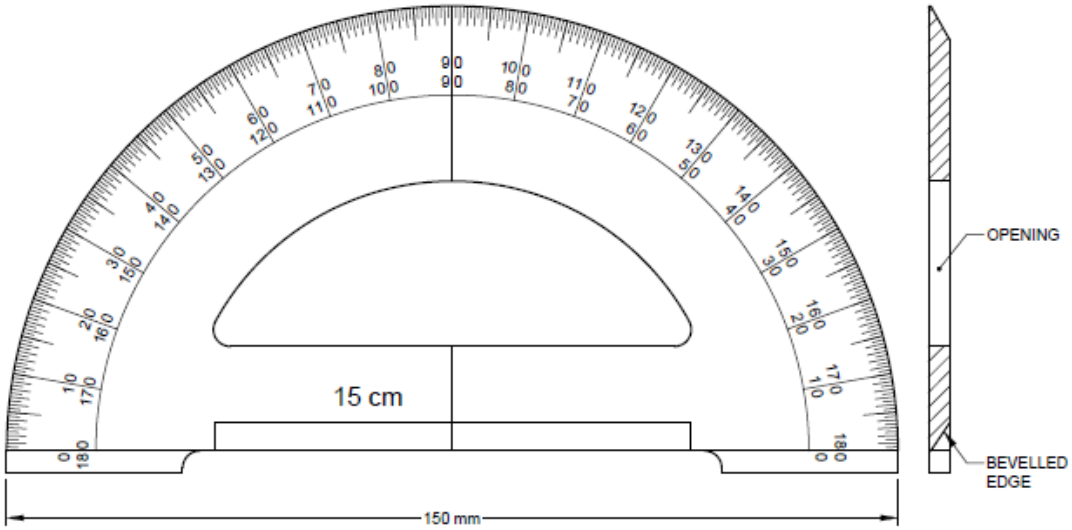
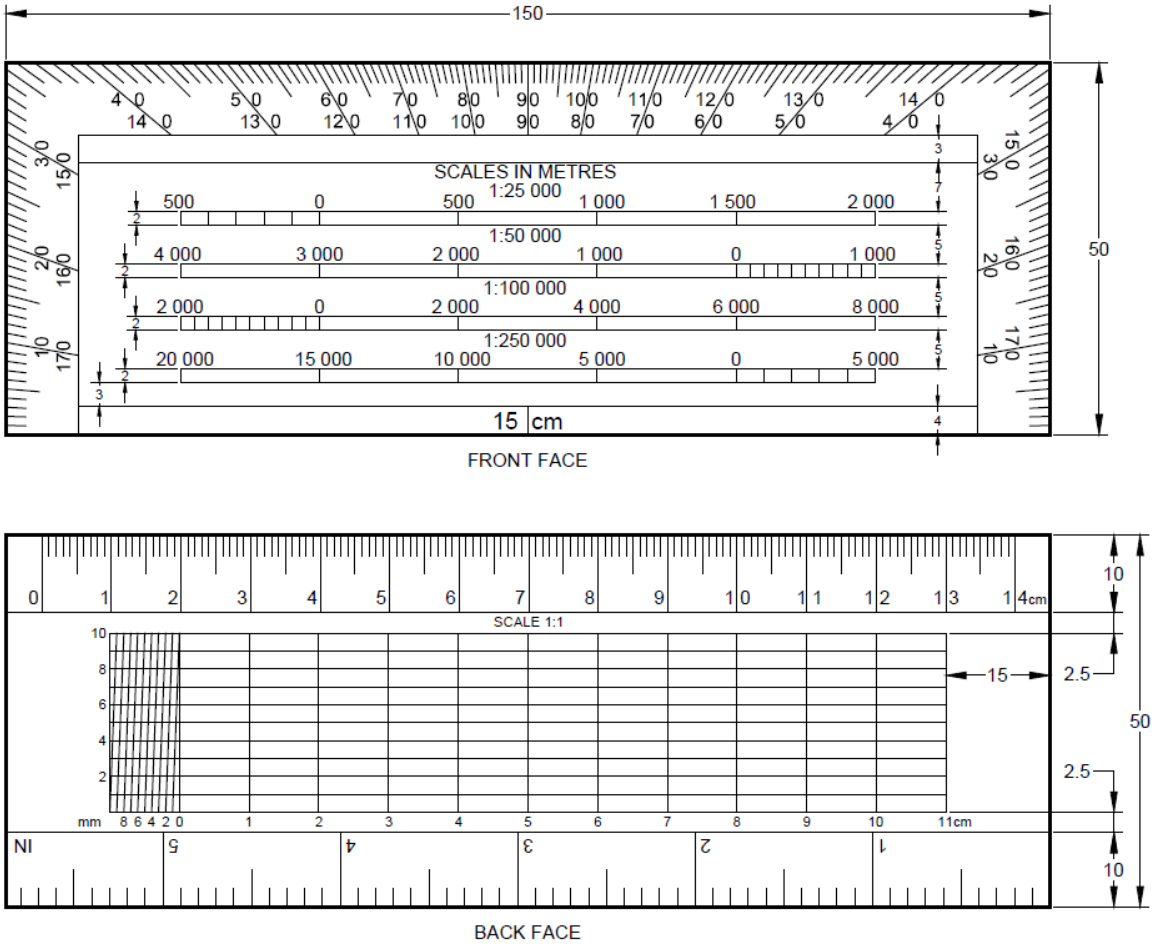


FIG.4 SEMI-CIRCULAR PROTRACTOR OF OPEN-CENTRE PATTERN



All dimensions in millimetres.

FIG. 5 RECTANGULAR PROTRACTOR

Table 1 Dimensions and Tolerances
(*Clause* 5.1)

Sl No.	Type	Diameter or Dimension mm	Tolerance mm	Graduation	Thickness of Material mm
(1)	(2)	(3)	(4)	(5)	(6)
(i)	Circular	300	± 1.5	1/2°	2.0
		250	± 1.5	1/2°	2.0
		200	± 1.5	1/2°	2.0
		150	± 1.5	1/2°	1.5
		100	± 1.5	1°	1.5
(ii)	Semi-circular	300	± 1.5	1/2°	2.0
		250	± 1.5	1/2°	2.0
		200	± 1.5	1/2°	2.0
		150	± 1.5	1/2°	1.5
		100	± 1.5	1°	1.5
(iii)	Rectangular	150 × 50	—	1°	1.5

6.2.2 The central portion of the working edge (line joining 0° and 180°) in the case of open-centre protractors shall be beveled.

6.3 The angular graduations shall be marked along the edges of one side and two ends of the front face of the rectangular strip. As in the case of circular and semi-circular protractors, the rectangular protractors shall be double reading and every 10th degree marks shall be figured. The style of numbering graduations shall be the same as specified for circular protractors under **6.1.1**.

The remaining fourth edge of the rectangular protractor shall be left blank and shall form the base line containing the centre of the protracting circle. A perpendicular line to the base line to indicate the position of the centre shall be marked and this line, on extension, shall pass through 90° graduation mark on the opposite edge.

6.3.1 In the blank spaces of the rectangular protractors, the following scales shall be shown:

Front Face (*which carries the angular graduation*)

Metric scale of 1 : 25 000
Metric scale of 1 : 50 000
Metric scale of 1 : 100 000
Metric scale of 1 : 250 000

Back Face

Diagonal scale in centimetre 1 : 1

Ordinary scale in centimetre 1 : 1

Ordinary scale in inch 1 : 1

7 TOLERANCE

Angular tolerance between any two graduations on the protracting line shall be ± 10 minutes. The tolerance on any linear dimension shall not exceed 1 percent for a variation in ambient temperature from 0 °C to 40 °C and relative humidity from 0 percent to 100 percent.

8 SAMPLING

8.1 Lot

All the protractors of the same type and size manufactured from the same material under similar conditions of production shall be grouped together to constitute a lot.

8.2 Unless otherwise agreed to between the supplier and the purchaser, the procedure given in IS 2500 (Part 1) shall be followed for sampling inspection. The inspection level, acceptable quality level (AQL) and type of sampling plan to be followed for various characteristics shall be as given in **8.2.1** and **8.2.2**.

8.2.1 For accuracy of angular values and linear dimensions between two graduations (*see* **7**) a single sampling plan with inspection level II and AQL of 1.0 percent as Table 1 and Table 2 of IS 2500 (Part 1) shall be followed.

8.2.2 For other requirements of manufacture, dimensions, graduations, a single sampling plan with inspection level II and AQL of 2.5 percent as given in Table 1 and Table 2 of IS 2500 (Part 1) shall be followed.

9 MARKING

9.1 The size of each protractor shall be marked legibly on its face as illustrated in Fig. 1 to Fig. 5 and letterings and figures indicating the size shall be 3 mm in height.

9.2 Each protractor shall be legibly and indelibly marked with maker's name or trade-mark, and the year of manufacture if required by the purchaser.

9.3 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the product(s) may be marked with the Standard Mark.

10 PACKING

Protractors shall be individually packed in paper or in plastic bags and then the consignment not exceeding 25 No. in a suitable cardboard carton.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Educational Instruments and Equipment Sectional Committee, PGD 22

Organization	*Representatives(s)*
In Personal Capacity (*7/57, second floor, old Rajinder Nagar, New Delhi - 110060*)	DR SUKHVIR SINGH **(*Chairperson*)**
Ambala Scientific Instruments Manufacturers Association, Ambala	SHRI ASHWANI GOEL SHRI PUNEET GUPTA (*Alternate*)
CSIR - Central Scientific Instruments Organisation, Chandigarh	DR S. V. RAMAGOPAL
Directorate General of Quality Assurance, Ministry of Defence, New Delhi	SHRI K. CHANDRASEKARAN
Directorate of Standardisation, Ministry of Defence, DTE of Standardization Government, New Delhi	GP CAPT M. K. PANI
Educational Consultant of India Limited, Noida	SHRI PRADEEP K. S. SHISHODIA SHRI NANDEESH BABU M. G. (*Alternate*)
Indian Association of Physics Teachers, Delhi	DR MAMTA
Industrial Design Product Design, IIT Delhi, New Delhi	SHRI LALIT KUMAR DAS
Instrument Research and Development Establishment, Dehradun	SHRI SUBHASH CHANDER KUMAR SHRI K. K. KAILASIA (*Alternate*)
Instruments Design Development and Facilities Centre, Ambala	SHRI J. K. S. GANGWAR
Kendriya Vidyalaya Sangathan, New Delhi	SHRI AVINASH DIKSHIT
Kohinoor Slides Rules Fabrik Private Limited, Varanasi	SHRI JEET RAJ MANKHAND
Malaviya National Institute of Technology, Jaipur	DR RAJENDRA KUMAR GOYAL DR RAJEEV AGRAWAL (*Alternate*)
Ministry of Science and Technology, Department of Science & Technology, New Delhi	DR LAXMAN PRASAD SHRI D. PRASAD RAJU (*Alternate*)
National Council of Educational Research and Training, New Delhi	DR GAGAN GUPTA PROF ALKA MEHROTRA (*Alternate*)
National Science Centre, New Delhi	SHRI A. S. MANEKAR
Office of Development Commissioner (MSME), New Delhi	SHRI S. VIJAYA KUMAR SHRI ALURI SURESH (*Alternate*)
Survey of India, Geodetic and Research Branch, Dehradun	SHRI MAM CHAND
BIS Directorate General	SHRI RAJEEV RANJAN SINGH SCIENTIST 'F'/ SENIOR DIRECTOR AND HEAD (PRODUCTION AND GENERAL ENGINEERING) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)]

Member Secretary
SHRI ASHUTOSH RAI
SCIENTIST 'B'/ASSISTANT DIRECTOR
(PRODUCTION AND GENERAL ENGINEERING), BIS

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

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 website-www.bis.gov.in or www.standardsbis.in.

This Indian Standard has been developed from Doc No.:PGD 22 (21724).

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: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices: *Telephones*

Central : 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002 { 2323 7617

Eastern : 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091 { 2367 0012 2320 9474

Northern : Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019 { 265 9930

Southern : C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113 { 2254 1442 2254 1216

Western : Plot No. E-9, Road No.-8, MIDC, Andheri (East), Mumbai 400093 { 2821 8093

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. CHANDIGARH. CHENNAI. COIMBATORE. DEHRADUN. DELHI. FARIDABAD. GHAZIABAD. GUWAHATI. HIMACHAL PRADESH. HUBLI. HYDERABAD. JAIPUR. JAMMU & KASHMIR. JAMSHEDPUR. KOCHI. KOLKATA. LUCKNOW. MADURAI. MUMBAI. NAGPUR. NOIDA. PANIPAT. PATNA. PUNE. RAIPUR. RAJKOT. SURAT. VISAKHAPATNAM.

Published by BIS, New Delhi