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मानक

IS 2594 (2003): Hacksaw Blades [PGD 32: Cutting tools]



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Indian Standard HACKSAW BLADES—SPECIFICATION (Second Revision)

ICS 25.100.20

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

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Milling Cutters, Saws, Gear Cutting Tools and Broaches Sectional Committee had been approved by the Basic and Production Engineering Division Council.

This standard was first published in 1963 and was revised in 1977. This second revision has been taken up to keep it abreast with international practices and to include the requirement of bi-metal hacksaw blades and tests for power hacksaw blades.

While preparing the standard assistance has been derived from the following International Standards:

- a) BS 1919 (Part 1): 1993 Hacksaw blades : Part 1 Specification for hand and machine hacksaw blades
- b) BS 1919 (Part 2): 1995 Hacksaw blades : Part 2 Specification for cutting performance
- c) ISO 2336-1 : 1996 Hacksaw blades Part 1 : Dimensions for hand blades
- d) ISO 2336-2 : 1996 Hacksaw blades --- Part 2 : Dimensions for machine blades

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 values should be the same as that of the specified value in this standard.

Indian Standard HACKSAW BLADES—SPECIFICATION (Second Revision)

1 SCOPE

This standard covers the dimensions, other requirements and tests for hand and machine hacksaw blades.

2 REFERENCES

The following standards 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:

IS No.	Title
1570	Schedules for wrought steels : Part 5
(Part 5) : 1985	Stainless and heat-resisting steels (second revision)
7226 : 1974	Cold rolled medium, high carbon and low alloy steel strip for general engineering purposes
7291 : 1981	High speed tool steels (first revision)

3 TERMINOLOGY

For the purpose of this standard, following definitions shall apply (see Fig. 1).

3.1 Elements

3.1.1 Centre Line

The longitudinal line which passes through the centres of the pin holes.

3.1.2 Pin Hole

The hole at each end of the blade by means of which the blade is held and tensioned when in use. The pin holes are normally located on the centre line of the blade.

3.1.3 Teeth

The serrations formed across the thickness of the blade to provide cutting edges.

3.1.4 Toothed Edge

The longitudinal edge along which the teeth have been formed.

3.1.5 Cutting Edge

The edge of the face intended to perform cutting. It is formed by the intersection of the flank and the face.

3.1.6 Face

The surface of the tooth over which the chip flows.

3.1.7 Flank

That surface over which the surfaces produced on the work piece pass. It extends to the root radius.

3.1.8 Root Radius

The radius connecting the face of the tooth and flank of the preceding tooth.

3.1.9 Gullet

The space bounded by the face, root radius and flank of a tooth, which permits chip removal.

3.1.10 Back Edge

The longitudinal edge parallel to the toothed edge.

3.1.11 Side

The flat surface between the toothed edge and the back edge.

3.1.12 Set

The projection of teeth from the side of the blade, to provide cutting clearance.

3.1.13 Staggered Set

The transverse setting or staggering of groups of teeth.

3.1.14 Wavy Set

The transverse setting or staggering of groups of teeth in the wave form.

3.2 Linear Dimensions

3.2.1 Nominal Length

The dimension between the centres of the pin holes, measured along the centre line of the blade.

3.2.2 Overall Length

The dimension between the ends of the blade measured along its centreline.

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3.2.3 Width

Width is the overall distance between the toothed edge and the back edge.

3.2.4 Thickness

The distance between the two sides of the blade body, excluding any set.

3.2.5 Pitch

The distance between the adjacent cutting edges.

4 TYPES

4.1 All Hard Blade (Type A)

A blade hardened uniformly except for the area adjacent to the pin holes.

4.2 Flexible Blade (Type B)

A blade hardened uniformly along the length of toothed edge.

4.3 Flexible Centre Blade (Type C)

A blade uniformly hardened and tempered along the length of toothed edge and the back edge with the centre of the blade in soft condition and the back edge either soft or hard.

4.4 Spring Back Blade (Type D)

A blade hardened uniformly along the length of toothed edge, the remainder being spring tempered.

4.5 Shatterproof Blade (Type E)

A hand hacksaw blade of any type or quality so manufactured that it will resist breakage but if breakage occur, it will not fragment into more than two pieces.

5 DIMENSIONS

The dimensions of hand hacksaw blade and machine hacksaw blade shall be as given in 5.1 and 5.2 respectively (*see* Fig. 2).

5.1 Hand Hacksaw Blades

Nominal	Width	Thickness	Teeth S	Spacing	Overall	Pinhole		
Length			Pitch,	No. of	Length	Diameter,		
1 ± 2	a ± 1	$b \pm 0.1$	$P \pm 6\%$	Teeth, N ¹⁾	L, Max	d H14		
(1)	(2)	(3)	(4)	(5)	(6)	(7)		
250			0.8	32	265			
	12.5	0.63	1.0	24		4		
300			1.4	18	315	ļ		
			1.8	14				
¹⁾ Number of teeth are per 25 mm length.								

All dimensions in millimetres

5.2 Machine Hacksaw Blades

All dimensions in millimetres.

Nominal	Width	Thickness	Teeth	Spacing	Overall	Pinhole	
Length			Pitch,	No. of	Length	Diameter.	
1±2	a ± 1	<i>b</i> ± 0.1	P ± 6%	Teeth, N ¹⁾	L, Max	d H14	
(1)	(2)	(3)	(4)	(5)	_(6)	(7)	
			1.0	14		·	
200	25	1.25	1.8	14	220		
300	25	1.25	2.5	10	330	8.2	
			4.0	0	[
	26	1.05	1.8	14			
	25	1.25	2.5	10	ł		
350			4.0	6	380	8.2	
550			1.8	14	ł		
	32	1.60	2.5	10]		
			4.0	6			
	25	1.25	1.8	14	ł		
			2.5	10	ļ		
400	32	1.60	2.5	10	430	82	
100			4.0	6		0.2	
	40	40	2.00	4.0	6	1	
			6.3	4		L	
	25	1.25	1.8	14			
			2.5	10]]	
	32	1.60	2.5_	10			
450			4.0	6	105	10.2	
430		1.60	2.5	10	465	10.2	
	40		4.0	6			
	10	2.00	4.0	6			
			6.3	4			
	40	2.00	2.5	10			
			4.0	6			
525	45	2.25	4.0	_6	560	10.2	
			6.3	4			
(0.0	50	2.50	4.0	6			
600			6.3	4	635	10.2	
750 ²⁾	63	2.50	6.3	4	885	10.2	

¹⁾ Number of teeth are per 25 mm length.

²⁾ Available in high-speed steel type only.

6 MATERIAL

Hand hacksaw blade and machine hacksaw blades shall be made from high speed steel in accordance with 6.1 or bi-metal high speed steel in accordance with 6.2. Hand hacksaw blade may also be made from low alloy steel in accordance with 6.3.

6.1 High-Speed Steel

Unless otherwise specified, the high-speed steel shall be according to Designation XT87W6Mo5Cr4V2 of IS 7291 or with following composition or equivalent in which case the major constituent shall be specified by the manufacturer.

С	Cr	Мо	W	v	Si	Mn	S&P
0.95	3.80	2.50	2.70	2.20	0.45	0.40	0.030
to	to	to	to	to	Max	Max	Max
1.03	4.50	2.90	3.00	2.50			



FIG. 1 TERMS RELATING TO HACKSAW BLADES



FIG. 2 DIMENSIONS OF HAND HACKSAW BLADES

6.2 Bi-metal High-Speed Steel

Bi-metal high-speed steel blades shall be manufactured with a tooth edge formed in high-speed steel and joined to a spring steel-backing strip.

6.3 Low Alloy Steel

Low alloy steel flexible blade shall be manufactured from high carbon steel, which contains sufficient-alloy addition to significantly enhance wear resistance properties.

NOTE — Unless otherwise specified the low alloy steel shall be according to Designation 120Cr35 or 110 Cr35W2, according to IS 7226.

7 HARDNESS

7.1 The hardness when measured, as near to the tip of the tooth as possible shall be minimum of 760 HV.

7.2 The area around the pin holes shall be suitably heattreated to reduce the risk of end fracture in use. The hardness around the pin holes shall be 270 to 500 HV (Rockwell 25.6 to 49.1 HV).

8 GENERAL REQUIREMENTS

8.1 The blades shall be manufactured reasonably straight true to shape and size. The pinholes shall be neatly punched. The out of straightness per 100 mm length of the blade in the longitudinal direction shall not exceed 0.6 mm for all types and sizes of hacksaw blades.

8.2 The teeth shall be cleaned and uniform along the wavy set or staggered toothed edge. The teeth of the blade shall be having set as follows:

a)	For pitch, P	=	0.8		wavy set
b)	For pitch, P	=	1.0 to 1.8	-	wavy or
					staggered set
c)	For pitch, P	>	1.8		staggered set

8.2.1 The formulation of the set, of either type, shall be symmetrical along the length of toothed edge.

8.3 The blades shall be heat-treated in such a manner that they fulfil the requirements of hardness as given in 7 and applicable flexibility as given in 13.1 and applicable cutting tests as given in 13.2.

8.4 The centre of pin hole shall be located on the centre line of the blade. The centre of offset may be within \pm 0.20 mm.

9 DESIGNATION

Hacksaw blades shall be designated by the name, type, nominal length, width, thickness, pitch, number of this standard and the symbol for material.

Example 1

A hand hacksaw blade of Type A having nominal

length, l = 300 mm; width, a = 12.5 mm; thickness, b = 0.63 mm; pitch, P = 1.0 mm conforming to this standard and made from low alloy steel (LA) shall be designated as:

Hand Hacksaw Blade, A 300 × 12.5 × 0.63 × 1.0 IS 2594-LA

Example 2

A machine hacksaw blade of Type A having nominal length, l = 400 mm; width, a = 32 mm; thickness, b = 1.60 mm; pitch, P = 2.5 mm; conforming to this standard and made from high-speed steel (HS) shall be designated as:

Machine Hacksaw Blade, A 400 \times 32 \times 1.60 \times 2.5 IS 2594-HS

Example 3

A machine hacksaw blade of Type A, having nominal length, l = 400 mm; width, a = 32 mm; thickness, b = 1.60 mm; pitch, P = 2.5; mm made from bi-metal HSS conforming to this standard shall be designated as:

Machine Hacksaw Blade, A 400 \times 32 \times 1.6 \times 2.5 IS 2594-HSS

10 WORKMANSHIP AND FINISH

The blades shall be free from burrs, rust, scale, other defects and freedom from distortion requirements.

11 MARKING

11.1 Each blade shall be marked with the following details:

- a) Manufacturer's name initial or trade-mark,
- b) Designation, and
- c) Month and year of manufacture, if required by the purchaser.

11.2 Standard Marking

Each blade may also be marked with the Standard Mark.

11.2.1 The use of the Standard Mark is governed by the provision of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulation made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufactures or producers may be obtained from the Bureau of Indian Standards.

12 PRESERVATION AND PACKING

The blades shall be coated with a suitable preservative or paint. Each wrapped packet shall contain five or ten blades and a suitable number of packets shall be packed in a carton bearing the designation, manufacturer's name, initial or trade-mark. Each carton shall contain same size of blades.

13 TESTS

13.1 Flexibility Test for Hand Hacksaw Blades

13.1.1 All Hard Blades

The blades shall be bent round the periphery of a test block of 250 mm, diameter until the blade throughout its length is in contact with the block (*see* Fig. 3). The blade when released shall show no sign of fracture or permanent set.

13.1.2 Flexible High-Speed Steel and Bi-metal High-Speed Steel Blades

The blades shall be bent round the whole circumference of a test bar 60 mm in diameter (*see* Fig. 4). The blade, when released with the exception of hardened portion, shall be capable of being straightened again without fracture.

13.1.3 Flexible Centre and Spring Back Blades

The blades shall be bent to lie on half the circumference

of a test bar of 100 mm diameter (see Fig. 5). The blade, when released, shall not show any sign of fracture or permanent set.

13.1.4 Shatterproof Blades

Test each blade to destruction by twist in the blade until rupture takes place using a suitable jig (*see* Fig. 6). Check that upon rupture, the blade does not break into more than two pieces.

13.2 Cutting Performance Test

When tested in accordance with Annex A, the wear rate of the hand or machine blade and the total time taken to complete the number of cuts shall not exceed the values given in Tables 1 and 2 for the type of blade tested.

The blade shall not produce a cut more than 3 mm out of square. The blade shall not break. A new blade shall be used for each test.

Table 1 Test Conditions and Acceptance Limits for Hand Blade Cutting Tests

(Clause 13.2)

Blade	Bl	ade Dimensi	ons	Speed, Strokes/min	No. of	Test	Wear Rate	Total Time	
Type	Thickness	Pitch	No. of Teeth	Suokesiini	Cuis	No. of Strips	Thickness of Strip	sec/cut	TIME
	mm	mm					mm		min
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
High-speed	0.63	1.8	14	70	10	10	2.6 ± 0.05	33	92
steel: all hard	0.63	1.4	18	70	10	10	2.6 ± 0.05	37	112
and bi-metal	0.63	1.0	24	70	10	9	2.6 ± 0.05	40	124
	0.63	0.8	32	70	10	8	2.6 ± 0.05	40	132
High-speed	0.63	1.8	14	70	8	10	2.6 ± 0.05	73	122
steel: flexible	0.63	1.4	18	70	8	10	2.6 ± 0.05	78	132
	0.63	1.0	24	70	8	9	2.6 ± 0.05	118	146
	0.63	0.8	32	70	8	8	2.6 ± 0.05	120	149
Low alloy	0.63	1.8	14	35	8	5	2.6 ± 0.05	44	134
steel: flexible	0.63	1.4	18	35	8	5	2.6 ± 0.05	40	123
	0.63	1.0	24	35	8	5	2.6 ± 0.05	34	147
	0.63	0.8	32	35	8	4	2.6 ± 0.05	37	127

Blade Dimensions			Speed,	No. of	Test	Wear	Total		
Length	Width	Thickness	Pitch	Strokes/min	Cuts	No. of Strips	Thickness of Strip	sec/cut	min
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
300 and 350	25	1.25	1.8	124	10	15	2.6 ± 0.05	66	66
300 and 350	25	1.25	2.5	124	10	20	2.6 ± 0.05	56	61
350 400 450	32	1.60	2.5	124	10	20	2.6 ± 0.05	65	87
350 400 450	32	1.60	4.0	124	10	25	2.6 ± 0.05	47	60
400 450	40	2.00	4.0	124	10	25	2.6 ± 0.05	81	80
400 450	40	2.00	6.3	124	10	25	2.6 ± 0.05	69	76

Table 2 Test Conditions and Acceptance Limits for Machine Blade Cutting Tests (High Speed Steel, All Hard and Bi-metal)

(Clause 13.2)



FIG. 3 FLEXIBILITY TEST FOR ALL HARD BLADES (TYPE A)



FIG. 4 FLEXIBILITY TEST FOR FLEXIBLE BLADES (TYPE B)



FIG. 5 FLEXIBILITY TEST FOR FLEXIBLE CENTRE AND Spring Back Blades (Type C and Type D)



FIG. 6 DESTRUCTION TEST APPARATUS FOR SHATTER PROOF (TYPE E) BLADES

ANNEX A

(Clause 13.2) METHODS FOR TESTING THE PERFORMANCE OF HAND AND POWER HACKSAW BLADES

A-1 PRINCIPLE

A-1.1 The cutting performances of hand and power hacksaw blades is assessed by subjecting sample blades to an accelerated test using calibrated hacksaw machines to control the variables in friction, stroke characteristics and loads.

A-1.2 The standard test bar is chosen to induce sufficient wear to the blade and to provide by its homogeneous structure reproducible machining characteristics.

A-2 TEST BAR

A-2.1 A test bar consisting of lengths of cold rolled 18/8 stainless steel strip as per IS 1570 (Part 5) shall be used.

A-2.2 The strip shall be 25.0 mm \pm 0.15 mm in width, 2.6 mm \pm 0.05 mm in thickness. The hardness shall be 180 \pm 12 HV30. The material shall have rolled or prepared edges. Ragged sheared edges are to be avoided.

A-3 APPARATUS

A-3.1 Test Machine for Hand Blades

A power hacksaw machine as follows:

- a) In good condition, particularly in respect of stroke alignment and freedom from excessive vibration;
- b) With main slides sufficiently free from friction to prevent variations in dynamic loads;
- c) With the main pivot on the same axis as the crank drive shaft;
- d) Which cuts on the forward stroke;
- e) Which presents the blade at an inclination of $1^{\circ}15' \pm 10'$ relative to the machine slides in the direction of cut;
- f) With a stroke length of 153 mm \pm 1 mm;
- g) With a cutting speed of 70 strokes/min ± 2 strokes/min when blades of high speed steel and bi-metal type are to be tested;
- h) With a cutting speed of 35 strokes/min ± 2 when blades of low alloy type are to be tested;
- j) With location facilities for the test bar so that when the machine is stroking, the test bar is positioned no closer than 50 mm from the blade pin holes;
- k) Which does not lift the reciprocating arm on the return stroke;
- m) Which exerts static loads on the test bar at the top of the cut in accordance with Table 3.

A-3.2 Test Machine for Machine Blades

A power hacksaw machine as follows:

- a) In good condition, particularly in respect of stroke alignment and freedom from excessive vibration;
- b) Which cuts on the return stroke;
- c) Which presents a blade at an inclination of $1^{\circ} 40' \pm 10'$ relative to the machine slides in the direction of cut;
- d) With a machine speed of 124 ± 2 cutting strokes/ min;
- e) With a stroke length of 133 mm \pm 1 mm;
- f) With location facilities for the test bar so that when the machine is stroking the test bar is positioned no closer than 50 mm from the blade pin holes;
- g) With lift-off on the non-cutting stroke synchronized so that no dynamic load is applied during the non-cutting stroke, and so that no dynamic load relief is applied during the cutting stroke;
- h) Which exerts static loads onto the test bar in accordance with Table 3;
- j) Which supplies a coolant, consisting of 100 g/l of Na₂CO₃.10H₂O in water, to the blade immediately above the test bar at a rate of 2 l/min minimum.

Table 3	Static 1	Load on	Test	Bar	at	Тор	Cut
	[(lause A	-3.1(n	n)]			

Position of Bow	Static Load, kg				
	For Hand Blades	For Machine Blades			
(1)	(2)	(3)			
Start of stroke	3.3 ± 0.1	69 ± 0.1			
Mid-stroke	5.7 ± 0.1	72 ± 0.1			
End of stroke	8.4 ± 0.1	75 ± 0.1			

A-4 PREPARATION OF TEST BLADES

There is no preparation required for hand blades. Correct machine blades to a length of 350 mm if necessary.

NOTES

1 Machine blades, because of their variation in length from 300 mm to 450 mm and the capacity limit of hack sawing machines, may need to be corrected to a blade length of 350 mm.

2 Testing in the unaltered length is valid if the bow capacity of the machine allows, and alteration of blade clamping mechanisms in the machine is also feasible.

A-5 TEST PROCEDURE

A-5.1 Calibrate the test machine to the loads given in Table 3 for hand blades and for machine blades.

A-5.2 Once the load has been adjusted to give the load specified, ensure that the jaw of the test bar clamp that is nearest the main pivot of the machine remains in a fixed position, irrespective of the number of test bar strips being used in the blade testing.

A-5.3 Position lengths of strip in accordance with Table 1 for hand blades, or Table 2 for machine blades, edge upwards in the machine work piece wise to form a pack approximately 25 mm deep.

NOTE — The actual width of the pack is determined by the number and thickness of strips given in Table 1 and 2.

A-6 ASSESSMENT OF RESULTS

Calculate the wear rate and total time as given in A-6.1 and A-6.2.

A-6.1 Wear Rate

Wear is represented by the recorded number of strokes plotted sequentially against section numbers. The average increase in wear per section cut is the slope of the plotted curve.

A mathematical value for this is derived by first performing a least squares linear regression which is designed to minimize the sum of the squares of the deviations of the actual recorded data points from the straight line of best fit and then calculating the slope of the line. This can be done automatically using a scientific calculator with linear regression facilities, or manually using the following formula:

Wear rate =
$$\frac{N\sum n X_n - \sum n \sum X_n}{N\sum n^2 - (\sum n)^2}$$

where

 \sum = sum between n = 1 and n = N;

N = number of cuts;

n = cut number; and

 $X_n =$ number of strokes per cut.

Use of a test sheet as shown in Fig. 7 and 8 at Annex B simplifies the calculation for practical purposes.

A-6.2 Total Time

The total time shall be calculated by dividing the cumulative number of strokes for the allotted number of sections to be cut by the number of strokes per minute performed by the machine.

A-7 TEST REPORT

Cutting performance test results shall state the nominal dimensions and tooth pitch of the blade, the type of blade, the stroking rate per minute of the machine and the number of strips used in the pack of test bars.

The following information shall be included in the test report:

- a) Wear rate (to the nearest whole number);
- b) Total time (to the nearest minute);
- c) Number of cuts completed by the blade; and
- d) Amount by which the blade cut out of square (if the amount exceeded 3 mm).

ANNEX B

(Clause A-6.1)

TYPICAL EXAMPLES OF TEST SHEETS AND CALCULATION OF TEST RESULT

B-1 FOR LOW ALLOY FLEXIBLE HAND HACKSAW BLADE

Wear rate = $\frac{(8 \times 11\ 840) - (36 \times 2\ 459)}{336}$ =18 sec/cut

Test bar: 4 strips batch xxxBlade type: Low alloy flexible hand hacksaw
bladeBlade size: 0.63 × 0.8 P (32)Machine speed : 35 strokes/min

Total time = $\frac{2\,459}{35}$ = 70 min

Cut	No of Strokes	Product	Comments
Number	X_{n}	$n \times X_{n}$	Commenus
n			
1	221	221	
2	268	536	
3	296	888	
4	305	1 232	
5	315	1 575	
6	335	2 010	
7	350	2 450	
8	366	2 928	
Total	2 459	11 840	



FIG. 7 GRAPHICAL REPRESENTATION OF NUMBER OF STROKES AND CUT NUMBER

B-2 FOR POWER HACKSAW BLADES

Test bar	:	15 strips batch yyy
Blade type	:	Power hacksaw blade 350 mm \times 25 mm
Blade size	:	1.25 × 1.8 <i>P</i> (14)
Machine speed	:	124 strokes/min

Wear rate =
$$\frac{(10 \times 29\ 847) - (55 \times 5\ 027)}{825}$$
 =27 sec/cut

Total time =
$$\frac{5\ 027}{124}$$
 = 41 min

Cut Number n	No. of Strokes X _n	$\begin{array}{c} Product\\ n \times X_n \end{array}$	Comments	
1	370	370		
2	410	820		
3	438	1 314		
4	478	1 912		
5	498	2 490		
6	514	3 084		
7	533	3 731		
8	567	4 536		
9	600	5 400		
10	619	6 190		
Total	5 027	29 847		



FIG. 8 GRAPHICAL REPRESENTATION OF NUMBER OF STROKES AND CUT NUMBER

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Review of Indian Standards

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This Indian Standard has been developed from Doc: No. BP 11 (0029).

Amendments Issued Since Publication

Amend No	D. Date of Issue	Text Affected
	BUREAU OF INDIAN ST	ANDARDS
Headquart	ers:	
Manak Bh Telephone	avan, 9 Bahadur Shah Zafar Marg, New Delhi 11000 s: 2323 0131, 2323 3375, 2323 9402	2 Telegrams: Manaksanstha (Common to all offices)
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Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	{2323 7617 2323 3841
Eastern	: 1/14 C.I.T. Scheme VII M, V.I.P. Road, Kankurga KOLKATA 700054	achi {2337 8499, 2337 8561 2337 8626, 2337 9120
Northern	: SCO 335-336, Sector 34-A, CHANDIGARH 1600	$ \begin{array}{c} 60 & 3843 \\ 60 & 9285 \end{array} $
Southern	: C.I.T. Campus, IV Cross Road, CHENNAI 60011	3 {2254 1216, 2254 1442 2254 2519, 2254 2315
Western	: Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400093	{ 2832 9295, 2832 7858 2832 7891, 2832 7892
Branches	: AHMEDABAD. BANGALORE. BHOPAL. BHU GHAZIABAD. GUWAHATI. HYDERABAD. NALAGARH PATNA PUNE. RAIKOT. THIR	BANESHWAR. COIMBATORE. FARIDABAD. JAIPUR. KANPUR. LUCKNOW. NAGPUR. UVANANTHAPURAM. VISAKHAPATNAM.