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IS 3961-5 (1968): Recommended current ratings for cables,
Part 5: PVC insulated light duty cables [ETD 9: Power
Cables]



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IS : 3961 (Part V) - 1968

(Reaffirmed 1996)

Indian Standard

RECOMMENDED CURRENT RATINGS FOR CABLES

PART V PVC INSULATED LIGHT DUTY CABLES

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

*Indian Standard***RECOMMENDED CURRENT RATINGS FOR
CABLES****PART V PVC INSULATED LIGHT DUTY CABLES**

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*Indian Standard***RECOMMENDED CURRENT RATINGS FOR
CABLES****PART V PVC INSULATED LIGHT DUTY CABLES****0. FOREWORD**

0.1 This Indian Standard (Part V) was adopted by the Indian Standards Institution on 29 November 1968, after the draft finalized by the Conductors and Cables Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 The values of current ratings have been based on the IEE Wiring Regulations (14th Edition) 1966. The IEE values have been plotted against the nominal area and values for metric nominal area obtained from the graph. For certain marginal sizes, extra polation was required to get the values.

0.2.1 The current ratings for aluminium conductored cables of sizes 1.5 to 16 mm² (both inclusive) given in Tables 6 and 7 have been computed by applying a factor 0.78 to the corresponding current ratings for copper conductored cables given in Tables 1 and 3 because IEE tables do not provide the values of current ratings of aluminium conductored cables of sizes below 19 mm². This factor 0.78 was arrived at by taking the average of the aluminium to copper ratios of current ratings given for unarmoured single and multi-core cables conforming to IS: 1554 (Part I)-1964*.

0.2.2 The excess current protection factors have been altered to suit the new ambient temperature of 40°C.

0.3 The rating factors specified shall be used to modify the current ratings in respect of ambient-temperature, class of excess current protection and grouping.

0.4 This is one of the series of Indian Standards on recommended current ratings for various types of cables. Others in the series are:

IS: 3961 (Part I)-1967 Recommended current ratings for cables:
Part I Paper-insulated lead-sheathed cables

IS: 3961 (Part II)-1967 Recommended current ratings for cables:
Part II PVC insulated and PVC sheathed heavy duty cables

*Specification for PVC insulated (heavy duty) electric cables: Part I For working voltages up to and including 1 100 volts (*revised*).

IS: 3961 (Part V) - 1968

IS: 3961 (Part III)-1968 Recommended current ratings for cables:
Part III Rubber insulated cables

IS: 3961 (Part IV)-1968 Recommended current ratings for cables:
Part IV Polythene insulated cables

0.5 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, shall be rounded off in accordance with IS: 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part V) covers recommended current ratings for both the copper conductored as well as aluminium conductored PVC insulated cables and copper conductored flexible cords covered by IS: 694 (Part I)-1964† and IS: 694 (Part II)-1964‡ respectively.

2. BASIC ASSUMPTIONS

2.1 The current ratings given in Tables 1 to 7 in the standard are based on the following assumptions:

- | | |
|----------------------------------|------------|
| a) Ambient air temperature | 40°C |
| b) Maximum conductor temperature | 70°C |
| c) Thermal resistivity of PVC | 650°C cm/W |

3. METHOD OF INSTALLATION

3.1 The current ratings given in this standard are for the methods of installation as given in the following table:

Type of Cable	Type of Installation	Method of Installation
Single-core cables	a) Bunched and enclosed in a conduit or trunking	i) 2 cables, single-phase ac or dc
		ii) 3 or 4 cables, three-phase ac
	b) Clipped direct to a surface or on a cable tray, bunched and unenclosed	i) 2 cables, single-phase ac or dc
		ii) 3 or 4 cables, three-phase ac

*Rules for rounding off numerical values (*revised*).

†Specification for PVC insulated cables (for voltages up to 1 100 volts):Part I With copper conductors (*revised*).

‡Specification for PVC insulated cables (for voltages up to 1 100 volts):Part II With aluminium conductors (*revised*).

<i>Type of Cable</i>	<i>Type of Installation</i>	<i>Method of Installation</i>
	c) Defined conditions	i) Flat or vertical (2 cables, single-phase ac or dc, or 3 or 4 cables, three-phase) ii) Trefoil (3 cables, three-phase)
Twin and Multi-core cables	a) Enclosed in a conduit or trunking	i) One twin-cable (with or without ECC), single-phase ac or dc ii) One three-or four-core cable, three-phase
	b) Clipped direct to a surface or on a cable tray and unenclosed	i) One twin-cable (with or without ECC), single-phase ac or dc ii) One three-or four-core cable, three-phase
	c) Defined conditions	i) One twin-cable (with or without ECC), single-phase ac or dc ii) One three-or four-core cable, three-phase

4. RATING FACTORS

4.1 For Ambient Temperature — The current ratings for cables given in the Tables 1 to 7 are based on an ambient air temperature of 40°C. Where the ambient air temperature differs from this value, the appropriate rating factor given in Table 8 shall be applied.

4.2 For Excess Current Protection — Cables insulated with some thermoplastic materials (for example PVC) may sustain serious damage when subjected, even for relatively short periods, to temperatures which are appreciably higher than those permissible for continuous operation. Therefore the current ratings of cables insulated with PVC are determined not only by the maximum conductor temperature admissible for continuous running, but also by the temperature likely to be attained under conditions of excess-current.

In the tables relating to these types of cable, therefore, the tabulated ratings are related to the class of excess-current protection afforded for the cables. For the purpose of this standard the following classes of excess-current protection shall apply.

4.2.1 Close Excess-Current Protection — Excess-current protection which will operate within four hours at 1.5 times the designed load current of the

circuit which it protects. Devices affording close excess-current protection include:

- a) Fuses fitted with fuse-links having a fusing factor not exceeding 1.5 marked (IS: 2208-1962*).
- b) Miniature and moulded-case circuit-breakers.
- c) Circuit-breakers set to operate at an overload not exceeding 1.5 times the designed load current of the circuit.

4.2.2 Coarse Excess-Current Protection — Excess-current protection which will not operate within four hours at 1.5 times the designed load current of the circuit which it protects. Devices affording coarse excess-current protection include:

- a) Fuses other than those described under close excess-current protection above.
- b) Carriers and bases used in rewirable type electric fuses complying with IS: 2086-1963†.

The heading to each table concerned states whether the tabulated ratings relate to close or coarse excess-current protection. Where the class of excess-current protection to be used differs from that stated in the heading to the table, the appropriate rating factor given in Table 8 shall be applied.

4.3 For Groups — The current ratings given in the various tables are for single circuits only. For groups, the appropriate rating factor given in Table 8 shall be applied.

4.4 For Defined Conditions — The current ratings in the columns of the tables headed 'defined conditions' apply to cables run under the conditions defined below:

4.4.1 Single-Core Cables

- a) Two or three single-core cables are installed one above the other, fixed to the vertical surface of a wall or open cable trench as follows, the distance between the wall and the surface of the cable being 25 mm in each instance.
 - 1) Cables in which the conductor cross-sectional area does not exceed 185 mm² are installed at a distance between centres of twice the overall diameter of the cable.
 - 2) Cables in which the conductor cross-sectional area exceeds 185 mm² are installed at a distance between centres of 90 mm.
 - 3) The ratings for two cables may be applied with safety in instances where such cables are installed in horizontal formation on

*Specification for HRC cartridge fuse links up to 650 volts.

†Specification for carriers and bases used in rewirable type electric fuses up to 650 volts (revised).

brackets fixed to a wall, either spaced as indicated above, or touching throughout.

- b) Three single-core cables are installed in trefoil formation, fixed to the vertical surface of a wall or open cable trench, the cables touching throughout and the distance between the wall and the surface of the nearest cable being 25 mm; or alternatively, three single-core cables are installed in trefoil formation and laid on a non-metallic floor, the cables touching each other and the floor throughout.

The cables are assumed to be remote from iron, steel, or ferroconcrete, other than the cable supports.

4.4.2 Multi-Core Cables—Cables of all types other than single-core cables are installed singly fixed to the vertical surface of a wall or open cable trench, the distance between the surface of the cable and the wall being 25 mm in every instance.

For cables spaced by distances less than those described above, the current ratings in the columns headed 'clipped direct to a surface' should be applied.

TABLE 1 SINGLE CIRCUIT CURRENT RATINGS FOR SINGLE-CORE PVC INSULATED SHEATHED AND UNSHEATHED COPPER CONDUCTORED CABLES OF SIZE 1 TO 50 mm² ACCORDING TO IS: 694 (PART I)-1964*

(CABLES PROVIDED WITH COARSE EXCESS-CURRENT PROTECTION)

(Clauses 0.2.1, 2.1 and 4.1)

NOMINAL CROSS- SECTIONAL AREA	NUMBER AND DIA- METER OF WIRES	BUNDLED AND ENCLOSED IN CONDUIT OR TRUNKING		CLIPPED DIRECT TO A SUR- FACE OR ON A CABLE TRAY, BUNDLED AND UNEN- CLOSED	
		2 Cables, Single- Phase ac or dc	3 or 4 Cables, 3-Phase ac	2 Cables, Single- Phase ac or dc	3 or 4 Cables, 3-Phase ac
(1)	(2)	(3)	(4)	(5)	(6)
mm ²	mm	A	A	A	A
1	1/1.12	11	9	12	12
1.5	1/1.40	13	11	16	15
2.5	1/1.80	18	16	22	20
4	1/2.24	24	20	29	26
6	1/2.80	31	25	37	33
10	7/1.40	42	35	51	45
16	7/1.70	57	48	68	61
25	7/2.24	71	60	86	78
35	7/2.50	91	77	110	99
50	19/1.80	120	100	145	135

*PVC insulated cables (for voltages up to 1 100 V): Part I With copper conductors (revised).

NOTE— For close excess-current protection, see rating factor in Table 8.

**TABLE 2 SINGLE CIRCUIT CURRENT RATINGS FOR SINGLE-CORE
PVC INSULATED SHEATHED AND UNSHEATHED COPPER
CONDUCTORED CABLES OF SIZE 70 TO 400 mm²**

ACCORDING TO IS: 694 (PART I)-1964*

(CABLES PROVIDED WITH CLOSE EXCESS-CURRENT PROTECTION)

(Clauses 2.1 and 4.1)

NOMINAL CROSS-SEC- TIONAL AREA	NUMBER AND DIA- METER OF WIRES	BUNCHED AND EN- CLOSED IN CONDUIT OR TRUNKING		CLIPPED DIRECT TO A SURFACE OR ON A CABLE TRAY, BUNCHED AND UNENCLOSED		DEFINED CONDITIONS	
		2 Cables, Single- Phase ac or dc	3 or 4 Cables, Three- Phase ac	2 Cables, Single- Phase ac or dc	3 or 4 Cables, Three- Phase ac	Flat or Vertical (2 Cables, Single- Phase ac or dc, or 3 or 4 Cables, Three- Phase)	Trefoil (3 Cables, Three- Phase)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
mm ²	mm	A	A	A	A	A	A
70	19/2-24	165	145	200	180	215	185
95	19/2-50	200	165	235	215	260	230
120	37/2-06	225	195	270	240	305	267
150	37/2-24	—	—	310	280	355	305
185	37/2-50	—	—	360	320	415	350
240	61/2-24	—	—	425	385	500	420
300	61/2-50	—	—	490	440	585	490
400	61/3-00	—	—	590	535	695	590

*PVC insulated cables (for voltages up to 1 100 V):Part I With copper conductors
(revised).

NOTE — For coarse excess-current protection, see rating factor in Table 8.

TABLE 3 SINGLE CIRCUIT CURRENT RATING FOR TWIN AND MULTI-CORE PVC INSULATED SHEATHED AND UNSHEATHED COPPER CONDUCTORED CABLES OF SIZE 1 TO 50 mm² ACCORDING TO IS: 694 (PART I)-1964*

(CABLES PROVIDED WITH COARSE EXCESS-CURRENT PROTECTION)

(*Clauses 0.2.1, 2.1 and 4.1*)

NOMINAL CROSS- SECTIONAL AREA	NUMBER AND DIAMETER OF WIRES	ENCLOSED IN CON- DUIT OR TRUNKING		CLIPPED DIRECT TO A SURFACE OR ON A CABLE TRAY AND UNENCLOSED		DEFINED CONDI- TIONS	
		One-Twin Cable with or Without Earth Continuity Conductor, Single- Phase ac or dc	One Three- or Four- Core Cable, Three- Phase	One-Twin Cable with or Without Earth Continuity Conductor, Single- Phase ac or dc	One Three- or Four- Core Cable, Three- Phase	One- Twin Cable with or Without Earth Continuity Conductor, Single- Phase ac or dc	One Three- or Four- Core Cable, Three- Phase
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
mm ²	mm	A	A	A	A	A	A
1	1/1.12	10	9	12	10	—	—
1.5	1/1.40	13	11	16	14	—	—
2.5	1/1.80	17	15	20	18	—	—
4	1/2.24	22	20	27	24	—	—
6	1/2.80	28	25	34	30	—	—
10	7/1.40	39	34	44	39	—	—
16	7/1.70	53	46	61	55	—	—
25	7/2.24	59	51	69	60	82	71
35	7/2.50	72	63	88	77	101	87
50	19/1.80	91	82	116	102	122	111

*PVC insulated cables (for voltages up to 1 100 V): Part I With copper conductors (*revised*).

NOTE — For close excess-current protection, *see* rating factor in Table 8.

**TABLE 4 SINGLE CIRCUIT CURRENT RATING FOR TWIN AND
MULTI-CORE PVC INSULATED SHEATHED AND UNSHEATHED
COPPER CONDUCTORED CABLES OF SIZE 70 TO 400 mm²
ACCORDING TO IS: 694 (PART I)-1964***
(CABLES PROVIDED WITH CLOSE EXCESS-CURRENT PROTECTION)
(Clauses 2.1 and 4.1)

NOMINAL CROSS-SEC- TIONAL AREA	NUMBER AND DIAMETER OF WIRES	CLIPPED DIRECT TO A SUR- FACE OR ON A CABLE TRAY, AND UNENCLOSED		DEFINED CONDITIONS	
		One Twin- Cable, Single-Phase ac or dc	One Three-or Four-Core Cable, Three- Phase	One Twin- Cable, Single- Phase ac or dc	One Three- or Four- Core Cable, Three- Phase
(1) mm ²	(2) mm	(3) A	(4) A	(5) A	(6) A
70	19/2-24	155	140	190	170
95	19/2-50	190	165	230	200
120	37/2-06	220	190	260	235
150	37/2-24	250	215	295	265
185	37/2-50	290	250	340	300
240	61/2-24	340	295	390	350
300	61/2-50	390	345	455	405
400	61/3-00	475	425	550	480

*PVC insulated cables (for voltages up to 1 100 V):Part I With copper conductors
(revised).

NOTE — For coarse excess-current protection, see rating factor in Table 8.

**TABLE 5 CURRENT RATINGS FOR COPPER CONDUCTORED
FLEXIBLE CORDS INSULATED WITH PVC ACCORDING
TO IS: 694 (PART I)-1964***

(Clauses 2.1 and 4.1)

NOMINAL CROSS-SECTIONAL AREA OF CONDUCTOR	NUMBER AND DIAMETER OF WIRES	CURRENT RATING dc OR SINGLE-PHASE ac, OR THREE-PHASE ac
(1) mm ²	(2) mm	(3) A
0.50	16/0-20	4
0.75	24/0-20	7
1.00	32/0-20	11
1.50	48/0-20	14
2.50	80/0-20	19
4.00	128/0-20	26

*PVC insulated cables (for voltages up to 1 100 V):Part I With copper conductors
(revised).

**TABLE 6 SINGLE CIRCUIT CURRENT RATINGS FOR SINGLE-CORE
PVC INSULATED SHEATHED AND UNSHEATHED ALUMINIUM
CONDUCTORED CABLES OF SIZE 1.5 TO 625 mm²
ACCORDING TO IS: 694 (PART II)-1964***

(CABLES PROVIDED WITH CLOSE EXCESS-CURRENT PROTECTION)

(Clauses 0.2.1, 2.1 and 4.1)

NOMINAL SECTIONAL AREA	NUMBER AND CROSS- DIAMETER OF WIRES	BUNCHED AND ENCLOSED IN CONDUIT OR TRUNKING		CLIPPED DIRECT TO A SURFACE OR ON A CABLE TRAY, BUNCHED AND UNENCLOSED		DEFINED CONDITIONS	
		2 Cables, Single- Phase ac or dc	3 or 4 Cables, Three- Phase ac	2 Cables, Single- Phase ac or dc	3 or 4 Cables, Three- Phase ac	Flat or Vertical (2 Cables Single- Phase ac or dc 3 or 4 Cables, Three- Phase ac)	Trefoil (Three Cables, Three- Phase ac)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
mm ²	mm	A	A	A	A	A	A
1.5	1/1.40	12	11	16	14	—	—
2.5	1/1.80	17	15	21	19	—	—
4	1/2.24	23	19	27	25	—	—
6	1/2.80	29	24	35	32	—	—
10	1/3.55	40	33	48	43	—	—
16	7/1.70	54	46	65	58	—	—
25	7/2.24	69	58	84	74	—	—
35	7/2.50	83	71	105	90	—	—
50	7/3.00	105	89	125	115	—	—
70	19/2.24	125	110	150	135	165	145
95	19/2.50	—	—	185	165	205	175
120	37/2.06	—	—	210	190	235	210
150	37/2.24	—	—	240	215	275	240
185	37/2.50	—	—	280	250	320	275
240	37/3.00	—	—	325	295	380	325
300	61/2.50	—	—	380	340	455	385
400	61/3.00	—	—	460	415	540	460
500	91/2.65	—	—	535	485	625	530
625	91/3.00	—	—	630	570	705	595

*PVC insulated cables, (for voltages up to 1 100 V): Part II With aluminium conductors (revised).

NOTE — For coarse excess-current protection, see rating factor in Table 8.

**TABLE 7 SINGLE CIRCUIT CURRENT RATINGS FOR TWIN AND
MULTI-CORE PVC INSULATED SHEATHED ALUMINIUM
CONDUCTED CABLES OF SIZE 155 TO 300 mm²
ACCORDING TO IS: 694 (PART II)-1964***

(CABLES PROVIDED WITH CLOSE EXCESS-CURRENT PROTECTION

(Clauses 0.2.1, 2.1 and 4.1)

NOMINAL CROSS- SECTIONAL AREA	NUMBER AND DIAMETER OF WIRES	ENCLOSED IN CON- DUIT OR TRUNKING	CLIPPED DIRECT TO A SURFACE OR ON A CABLE TRAY, AND UNENCLOSED				DEFINED CON- ITIONS
			Twin- Cable, Single- Phase ac or dc	Three-or Four-Core Cable, Three- Phase ac	Twin- Cable, Single- Phase ac or dc	3 or 4 Core Cable, Three- Phase ac	Twin- Cable, Single- Phase ac or dc
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
mm ^a	mm	A	A	A	A	A	A
1.5	1/1.40	12	10	15	13	—	—
2.5	1/1.80	16	14	19	17	—	—
4.0	1/2.24	21	19	26	23	—	—
6.0	1/2.80	27	24	32	28	—	—
10	1/3.55	37	32	42	37	—	—
16	7/1.70	50	44	58	52	—	—
25	7/2.24	57	49	66	56	78	69
35	7/2.50	69	61	82	71	94	80
50	7/3.00	87	78	98	85	120	105
70	19/2.24	—	—	120	105	150	130
95	19/2.50	—	—	145	125	175	155
120	37/2.06	—	—	170	145	200	180
150	37/2.24	—	—	195	170	230	205
185	37/2.50	—	—	225	195	260	235
240	37/3.00	—	—	265	230	305	270
300	61/2.50	—	—	305	265	350	310

*PVC insulated cables (for voltages up to 1 100 V): Part II With aluminium conductors (*revised*).

NOTE — For close excess-current protection, *see* rating factor in Table 8.

TABLE 8 RATING FACTORS FOR EXCESS-CURRENT PROTECTION, AMBIENT TEMPERATURE AND GROUPING OF CABLES

(Clauses 4.1, 4.2.2 and 4.3)

a) For Class of Excess-Current Protection

- 1) Rating factor close excess-current protection 1.23
- 2) Rating factor coarse excess-current protection 0.81

b) For Ambient Temperature

Ambient temperature °C	25	30	35	40	45	50	55	60	65
1) <i>Rating factor for cables</i>									
Cables having coarse excess-current protection	1.09	1.06	1.03	1.00	0.97	0.94	0.82	0.67	0.46
Cables having close excess-current protection	1.22	1.15	1.08	1.00	0.91	0.82	0.70	0.57	0.40
2) <i>Rating factor flexible cords</i>	—	1.09	1.04	1.00	0.95	0.77	0.54	—	—

NOTE 1 — The rating factor for close protection is derived from the formula $Q = \sqrt{\frac{70-A}{30}}$ where Q is the rating factor, and A is the ambient temperature.

NOTE 2 — The rating factor for coarse protection is derived from the formula $Q = \sqrt{\frac{T_e - A}{R_e}}$ where T_e is the limiting excess-current temperature, R_e is the limiting temperature-rise under excess-current conditions, and A is the ambient temperature (for PVC cables, R_e is assumed to be 90°C).

c) For Groups

For groups of circuits unenclosed, the single-circuit ratings apply provided that:

- 1) the horizontal clearance between circuit is:
 - i) not less than 6 times the overall diameter of an individual cable; and
 - ii) not less than overall width of an individual circuit, except that the horizontal clearance need not in any case exceed 150 mm;
- 2) the vertical clearance between circuits is not less than 150 mm; and
- 3) if the number of circuits exceed 4, they are installed in a horizontal plane. In all other cases, unless a more precise evaluation of current rating has been made based on experimental work or calculated data the following factors are applicable:

Number of circuits (pairs of cables, single-phase ac or dc 3 cables per circuit, or 4 where one is the neutral, 3-phase ac)	2	3	4	5	6	8	10	12	14	16*	18*	20*
Rating factor { Single-core cables	0.80	0.69	0.62	0.59	0.55	0.51	0.48	0.43	0.41	0.39	0.38	0.36
{ Twin and multi-core	0.80	0.70	0.65	0.60	0.57	0.52	0.48	0.45	0.43	0.41	0.39	0.38

*In case of single-core cables, not applicable to 3 phase.

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones: 323 0131, 323 3375, 323 9402

Fax : 91 11 3234062, 91 11 3239399, 91 11 3239382

Telegrams : Manaksanstha
(Common to all Offices)
Telephone

Central Laboratory:

Plot No. 20/9, Site IV, Sahibabad Industrial Area, Sahibabad 201010

8-77 00 32

Regional Offices:

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002 323 76 17

*Eastern : 1/14 CIT Scheme VII M, V.I.P. Road, Maniktola, CALCUTTA 700054 337 86 62

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022 60 38 43

Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113 235 23 15

†Western : Manakalaya, E9, Behind Marol Telephone Exchange, Andheri (East),
MUMBAI 400093 832 92 95

Branch Offices:

'Pushpak', Nurmohamed Shaikh Marg, Khanpur, AHMEDABAD 380001 550 13 48

‡Peenya Industrial Area, 1st Stage, Bangalore-Tumkur Road,
BANGALORE 560058 839 49 55

Gangotri Complex, 5th Floor, Bhadbhada Road, T.T. Nagar, BHOPAL 462003 55 40 21

Plot No. 62-63, Unit VI, Ganga Nagar, BHUBANESHWAR 751001 40 36 27

Kalaikathir Buildings, 670 Avinashi Road, COIMBATORE 641037 21 01 41

Plot No. 43, Sector 16 A, Mathura Road, FARIDABAD 121001 8-28 88 01

Savitri Complex, 116 G.T. Road, GHAZIABAD 201001 8-71 19 96

53/5 Ward No.29, R.G. Barua Road, 5th By-lane, GUWAHATI 781003 54 11 37

5-8-56C, L.N. Gupta Marg, Nampally Station Road, HYDERABAD 500001 20 10 83

E-52, Chitaranjan Marg, C-Scheme, JAIPUR 302001 37 29 25

117/418 B, Sarvodaya Nagar, KANPUR 208005 21 68 76

Seth Bhawan, 2nd Floor, Behind Leela Cinema, Naval Kishore Road,
LUCKNOW 226001 23 89 23

NIT Building, Second Floor, Gokulpat Market, NAGPUR 440010 52 51 71

Patliputra Industrial Estate, PATNA 800013 26 23 05

Institution of Engineers (India) Building 1332 Shivaji Nagar, PUNE 411005 32 36 35

T.C. No. 14/1421, University P. O. Palayam, THIRUVANANTHAPURAM 695034 6 21 17

*Sales Office is at 5 Chowringhee Approach, P.O. Princep Street,
CALCUTTA 700072 27 10 85

†Sales Office is at Novelty Chambers, Grant Road, MUMBAI 400007 309 65 28

‡Sales Office is at 'F' Block, Unity Building, Narashimaraja Square,
BANGALORE 560002 222 39 71