IS 12120 (1987): Code of practice for preservation of plywood and other panel products [CED 20: Wood and other Lignocellulosic products]

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IS : 12120 -1987
(Reaffirmed 2010)

Indian Standard

CODE OF PRACTICE FOR PRESERVATION OF PLYWOOD AND OTHER PANEL PRODUCTS

(First Reprint JULY 1999)

UDC 674.243.048

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

Gr 4 *February* 1988

Indian Standard

CODE OF PRACTICE FOR PRESERVATION OF PLYWOOD AND OTHER PANEL PRODUCTS

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AMENDMENT NO. 1 MARCH 2001
TO
IS 12120 : 1987 CODE OF PRACTICE FOR PRESERVATION OF PLYWOOD AND OTHER PANEL PRODUCTS

[*Page* 5, *clause* 3.1(b)] Substitute 'trichlorophenol' *for* 'pentachlorophenol'.

[*Page* 6, *Table* 1, 1(d), *third line*] — Substitute 'sodium pentachlorophenate, 2 percent solution in water, trichlorophenol, 5 percent solution in light organic solvent' *for* 'pentachlorophenol, 5 percent in suitable solvent like fuel oil' .

[*Page* 6, *Table* 1, (2c)] — Substitute 'sodium pentachlorophenate or trichlorophenol' *for* 'pentachlorophenol'.

(CED 20)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 AUGUST 2002
TO
IS 12120 : 1987 CODE OF PRACTICE FOR PRESERVATION OF PLYWOOD AND OTHER PANEL PRODUCTS

[*Page* 5, *clause* **3.1**(b), *lines* 2 *and* 3 (*see also Amendment No.* 1)] — Substitute 'trichlorophenol, gamma - BHC (lindane) and chloropyrifos' *for* 'pentachlorophenol, benzene hexachloride and p, p'-dichlorodiphenyl - trichloroethane (DDT)'.

[*Page* 5, *clause* **3.1**(c)] — Substitute the following for the existing:

'c) Type 3 *(Water Soluble, Non-fixed Type)* — Boric acid, borax and sodium pentachlorophenate.'

(*Page* 6, *Table* 1, *Sl No.* 2) — Substitute the following for the existing:

'a) Copper and zinc naphthenates, b) Copper and zinc abielates, c) Trichlorophenol, d) gamma-benzene hexachloride (lindane), and e) Chloropyrifos'

(*Page* 10, *clause* **5.5**) — Substitute the following for the existing clause:

'5.5 Glue Line Poisoning

For the treatment of plywood meant for use in interior dry locations only, toxins could be added in glue against powder post beatles (borers) during glue mixing stage as follows, thus making the treatment procedure very simple:

a) For amino resins — 2% level boric acid or boric acid — borax at 1:1 level, and

b) For phenolic resins — 1% level chloropyrifos or 1% lindane.'

(CED 20)

Reprography Unit, BIS, New Delhi, India

Indian Standard

CODE OF PRACTICE FOR PRESERVATION OF PLYWOOD AND OTHER PANEL PRODUCTS

0. FOREWORD

0.1 This Indian Standard was adopted by the Bureau of Indian Standards on 29 June 1987, after the draft finalized by the Wood Products Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 This standard gives details for protection of plywood, blockboard, flushdoor and particle board (or the material used to manufacture these before gluing) used internally or externally under diverse conditions to give economic service life. The protection envisaged is against all forms of biological agencies causing deterioration/destruction. While the code gives details on preservatives and processes to be employed and their absorption, special requirements for specific use by customers can be had through mutual understanding within the framework of the broad recommendations given in the standard.

0.3 In general, preservatives employed, methods of application and recommended absorptions are substantially similar to those specified for solid wood in IS : 401-1982*. In the case of species, which are not naturally durable and seasoned, and which are also extremely difficult to be impregnated, treatment to refusal by pressure process is the only recourse; but in the green state they are amenable to treatment by the diffusion treatment.

0.4 Methods have been detailed for introducing the preservative chemicals at the veneer or particle or batten stage. Most of the preservatives are likely to interfere with the gluing of veneers, etc. As such, care should be taken that the glue strength is not impaired by the preservative either at the time of gluing or in long storage and use, that is, there must be compatibility between the preservatives and the glue used.

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*Code of practice for preservation of timber (*third revision*).

0.5 The presence of any of the preservatives on the surface of the treated material may interfere with subsequent gluing operations and the user should seek the advice of manufacturer. Similarly, for painting purpose the manufacturer should be consulted regarding the appearance and paintability of the finished treated material.

0.6 Since some of the preservatives recommended are toxic and even harmful to the skin and eyes, the advice of the manufacturers of the preservatives and the factories imparting treatment should be sought for. Generally, exposed cuts in the body should be covered and the labour engaged in the compounding of the preservatives, the operators in the preservation plant should be provided with goggles to protect the eyes, gas-mask, gloves and gumboots when in contact with the preservatives. It is preferable to apply suitable vaseline on the exposed skin that is likely to come in contact with the chemicals.

0.7 In the case of building timbers and panels, in addition to using treated material, better service can be had if damp-proof and termite repellent foundations are provided and further the mortar used may be mixed with termite repellent chemicals particularly up to plinth and at least one metre above it. Periodical examination should be made to remove wood or other materials including plants contacting or connecting the ground and the walls which may act as a bridge for termites to reach unprotected walls above the treated position.

0.8 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*. 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 covers preservative treatment of wood panel products and the raw materials, such as stiles, battens, veneers and wood chips (particles) used to manufacture these products against biological damage; that is, sap-stain, wood rotting fungi, termite, insects, marine borers and bacteria in order to obtain satisfactory economic life.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 707-1976† and IS : 401-1982‡ shall apply.

*Rules for rounding off numerical values (*revised*).
†Glossary of terms applicable to timber technology and utilization (*second revision*).
‡Code of practice for preservation of timber (*third revision*).

3. TYPES OF PRESERVATIVES

3.1 The preservatives used shall be any of the following four types each consisting of one or more of the chemicals mentioned:

a) *Type 1 (Oil Type)* — Coal tar creosote with or without admixture with various grades of petroleum or other suitable oils having high boiling point; also creosote coal-tar mixture particularly for protection against marine borers.

b) *Type 2 (Organic Solvent Type)* — Copper and zinc naphthenates, and copper acetate, pentachlorophenol, benzene hexachloride and p, p'-dichlorodiphenyl-trichloroethane (DDT), dieldrin and similar contact insecticides.

c) *Type 3 (Water Soluble Non-fixed Type)* — Zinc chloride, boric acid, borax, sodium fluoride and sodium pentachlorophenate.

d) *Type 4 (Water Soluble 'Fixed' Type)* — Copper-chrome arsenic composition, chromated zinc chloride and copper-chrome-boric composition.

NOTE — IS : 401-1982* gives the description of preservatives of the above four types.

4. TREATMENT

4.1 Choice of Treatment

4.1.1 The choice of treatment is governed by the timber species used in the product, its sapwood content and the end use after treatment.

4.1.2 Sapwood of all species of timber and heartwood of non-durable species require treatment. Heartwood of durable species also require treatment particularly if the product is to be placed in the ground or is required to give long service life under severe conditions, for example, in the case of structures like boats, pontoons, boxes containing military equipment, etc, termite infested area and specially under marine environment.

4.1.3 The recommended practices with regard to the choice of preservative, treatment process, the amount of absorption and the penetration of the preservatives are given in Tables 1 and 2.

4.1.4 Information with regard to durability and degree of treatability of different species of timbers is given in Appendix B of IS : 401-1982*.

*Code of practice for preservation of timber (*third revision*).

TABLE 1 DETAILS OF PRESERVATIVES AND THEIR COMPOSITION

(*Clauses* 4.1.3, 8.2 *and* 8.2.1)

1) (a) Coal tar creosote; (b) creosote fuel oil 50 : 50; (c) creosote coal tar (60 : 40); (d) pentachlorophenol, 5 percent in suitable solvent like fuel oil; and (e) coal tar emulsion, where necessary, with 0·1 percent sodium pentachlorophenate.

2) (a) Copper and zinc naphthenates, (b) copper and zinc abietates, (c) pentachlorophenol, (d) benzene hexachloride (BHC), (e) p, p'-dichlorodiphenyl-trichloroethane (DDT), and (f) dieldrin and similar chemicals in easily vapourisable organic solvents.

3) *Water soluble dispersible and leachable type*

(a) Zinc chloride (1-2 percent in water); (b) boric acid (1·25-2 percent in water), (c) borax (1·9-3 percent in water); (d) sodium pentachlorophenate (Na — PCP), (5 percent in water); (e) benzene hexachloride (water dispersible power, 2 percent in water); (f) sodium fluoride (2 percent in water); and (g) boric acid : borax : Na — PCP (1 : 1 : 0·1) (2·5-5 percent in water).

4) *Water soluble (fixed) type*

a) *Chromated zinc-chlorides*, 4-6 percent in water,

Zinc chloride ($ZnCl_2$)	81·5 percent or 4 parts by weight
Sodium dichromate ($Na_2Cr_2O_7.2H_2O$) or Potassium dichromate, $K_2Cr_2O_7$	18·5 percent or 1 part by weight

b) *Acid-cupric-chromate (ACC)*, 4-6 percent in water

Chromic acetate/boric acid [$Cr(C_2H_3O_2)_3 H_3O$]	5 or 1	Parts by weight
Copper sulphate ($CuSO_4.5H_2O$)	50 or 10	
Sodium or potassium dichromate ($Na_2Cr_2O_7.2H_2O$ or $K_2Cr_2O_7$)	45 or 10	

c) *Copper-chrome-boron (CCB)*, 4-6 percent in water

Boric acid (H_3BO_3)	1 or 0·1	Parts by weight
Copper sulphate ($CuSO_4.5H_2O$)	10 or 1·0	
Sodium dichromate ($Na_2Cr_2O_7.2H_2O$) or Potassium dichromate ($K_2Cr_2O_7$)	10 or 1·0	

d) *Copper-chrome-arsenic (CCA)*, 4-6 percent in water

Arsenic pentoxide ($As_2O_5.2H_2O$)	12·5 or 1	Parts by weight
Copper sulphate ($CuSO_4.5H_2O$)	37·5 or 3	
Sodium or potassium dichromate ($Na_2Cr_2O_7.2H_2O$ or $K_2Cr_2O_7$)	50·0 or 4	

Process of treatment

1) Brushing, dipping and diffusion
2) Hot and cold
3) Full-cell/refusal
4) Lowry

TABLE 2 RECOMMENDED CODE OF PRACTICE FOR PRESERVATIVE TREATMENT OF PLYWOOD AND OTHER WOOD PANEL PRODUCTS UNDER VARIOUS SERVICE CONDITIONS

(*Clauses* 4.1.3, 8.2 *and* 8.2.1)

Sl No.	Anticipated Service Condition for Different Products	Process (*see* Table 1)	Preservative Chemicals and Minimum Absorptions kg/m³ (Composition, *see* Table 1)	Remarks
i)	Preservation of green veneer	1	3(b) (c) (d) (g) (1)	
ii)	Preservation of chips or particles for particle board	1	3(g) (0·5 to 1·0)	
iii)	Plywood in contact with sea water or in cooling towers	2 ; 3 ; 4	1(a) and (c) (160); 4(d)(32)	
iv)	Plywood in the open but exposed to wetting and drying regularly or occasionally including shuttering or forms	2 ; 3 ; 4	1(a) and 1(b) (160); 4(b)(16); 4(d) (12)	
v)	Plywood in the open and in contact with land	2 ; 3 ; 4	1(a) and 1(b) (130); 1(d) (8); 4(b or c)(12); 4(d)(12)	
vi)	Plywood in the open and in contact with sweet water or in the marine environment as inside structure	2 ; 3 ; 4	1(a)(b) and (c); 4(b or d) (1)	
vii)	Plywood in the open, out of contact with land or water excepting when stored or, such as, body and floor of trucks, etc	2 ; 3 ; 4	1(a)(b) and (c)(80); 1(d) (6); 4(b) (10); 4(d) (8)	In case of very refractory species full cell to refusal may be used. In case of green timber the diffusion or Lowry process may be used and stacked closely under cover for 2 weeks. For brush treatment 6 percent solution may be used and 2 coats be given, the second after first dries. Other preservatives given in Table 1 may also be used
viii)	Plywood, blockboard/flush door and particle board, indoor but in contact with walls or humid regions like cold storage and underground cellars or mines	2 ; 3 ; 4	1(a) and (b)(80); 1(d)(5); 4(b or c) (6-8)	
ix)	Plywood, blockboard/flush door and particle board, under cover and embedded in the walls	2 ; 3 ; 4	1(d)(5); 4(b or d)(5)	
x)	Plywood partially exposed and partially covered, as containers, packing cases	2 ;3 ; 4	1(d)(4); 4(b or d)(4)	
xi)	Plywood, blockboard/flush door, particle board for furniture under cover and not in contact with or embedded in the walls like cupboard	1 ; 4	1(d)(2); 4 (b or d)(3)	

General remarks — 1) It is presumed that all materials from timbers requiring treatment as above are non-durable or mostly sapwood even of durable woods or agricultural wastes. If durability is higher absorption may be suitably reduced.

2) If treated material requires further painting, coal tar or oily preservatives may be avoided.

4.2 Preparation of Material for Treatment

4.2.1 Preparation of the material for treatment shall be clean, free from oil or dirt patches on the surface and be at a moisture content not exceeding 16 percent. If it is possible, particularly for method of treatment as given in **5.1**, material which requires cutting to size, boring, etc, should be finished before treatment as otherwise untreated or inadequately treated material may be exposed to damage/deterioration.

4.2.2 In case of veneered decorative surface, care shall be taken that the colour of the preservative does not spoil, discolour, stain or impair the material in any way.

4.2.3 The glued material for treatment shall be bonded with water resistant glue of the BWR/BWP type conforming to IS : 848-1974* and this is specially required when used under marine environment or is to be treated using water soluble preservative.

4.2.4 For treatment of the material by method as given in **5.2**, the moisture content of it before treatment shall be taken into account to determine the period of soaking or diffusion of the toxic ions.

5. TYPES OF TREATMENT

5.1 Surface Application — This is done by brushing, spraying or dipping in the preservative solution for short period. Spraying on green materials like logs on all the surfaces including the cut ends and so also green chips will be useful. Cut ends of the logs may be additionally protected with anti-splitting compositions. The protection will be better if the bark is removed as damage to the bark during transport may expose unprotected surface to biological attack. Green veneers can be passed through suitable water soluble type of preservative composition as they come out of the slicer or peeler. With regard to oil type of preservative, the moisture content in the material shall be as low as possible, but not more than 14 percent. With aqueous solution, however, a moisture content of 20-30 percent is permissible and advisable because the preservative can diffuse further after impregnation. In the case of brushing, the second coat, as mentioned earlier, should be given after the first has just dried. Where possible, hot treatment is preferable. Surface treatment, in general, has limited scope and is used for treating material at site and for re-treatment of cut surfaces. The treatment may have to be repeated periodically, if fresh infection is noticed.

5.2 Soaking Treatment — In this process, the material (veneers or chips) is thoroughly dipped in the preservative solution for sufficiently long period until the required absorption is obtained. Normally, coaking

*Specification for synthetic resin adhesive for plywood (phenolic and aminoplastic) (*first revision*).

of dry veneers, separated by spacers in the preservative solution for a period of 15-30 minutes, while stirring the same is adequate for thicknesses up to 1·6 mm in the case of refractory species; and up to 3 mm with others. With plywood, which is taken out from the press in hot condition, it should be shifted immediately to the tank containing the cold preservative.

5.2.1 *Diffusion Process* — In this process, as in the soaking treatment (*see* **5.2**), the green veneers are placed in a water solution of the required preservative (fixed or leachable type) and kept submerged in the same for getting the desired absorption. The toxic ions diffuse into the veneers but if done properly no water as such moves from the solution into the wood which is expected to be already saturated with it. The veneer stack is then taken out and kept under shade and covered with tarpaulin both to protect it against leaching of the preservative due to rain and also to obtain slow drying so that the toxic ions get opportunity to penetrate deeper inside almost to the core. It is noticed that, with this process, better penetration of the toxic ions takes places then even by pressure process (described below) even in extremely difficult-to-treat timbers. The depth of penetration and the amount of preservative absorbed in the diffusion process depends on the concentration of the preservative, the diffusion rate of the ions, the period of diffusion, species of timber, its moisture content, its thickness, atmospheric/preservative temperature, etc.

5.3 Hot and Cold Process — In this process, plywood of BWP/BWR grade is submerged in the preservative oil or water solution, which is then heated to about 90°C and maintained at this temperature for a suitable period, depending on the charge. It is then allowed to cool down until the required absorption of preservative is obtained. During the heating period the air in the plywood expands and the moisture is converted into vapour and is expelled; during cooling the residual vapour in the plywood contracts, creating a partial vacuum, which causes the preservatives to be sucked in under atmospheric pressure from outside. As mentioned earlier, hot plywood from the press can be placed in the cold preservative; with water soluble preservatives, the bond should be of BWR type; with the fixed type of preservative, there is a danger of the components reacting and precipitating and, therefore, two tanks are to be used, one for heating which should have only water as a medium and the second containing the cold preservative. This treatment also ensures sterilization of the material against incipient decay or slight insect attack, if any.

5.4 Pressure Process — Pressure process may be employed with any preservative, generally in the cold with water soluble and solvent type of preservatives. With oil type of preservatives, a temperature of 80°-90°C requires to be maintained throughout the pressure period. With solvent type of preservatives, suitable lower temperatures can be used.

5.4.1 *Full Cell or Bethel Process* — This process is used when maximum absorption of the preservative is desired, that is, filling up the cells and saturating cell walls with the preservative. The charge is introduced into the cylinder. In the case of plywood or other panel products spacers or grills or any other convenient material should be used to separate the pieces. The door is tightly closed and then a vacuum of at least 55 cm of mercury is created and maintained for half an hour. The object of this operation is to remove as much air and moisture as possible from the cells. At the end of the vacuum period, the preservative is introduced into the cylinder with the vacuum pump still working. When the cylinder has been filled with the preservative, the vacuum pump is stopped and the cylinder is subjected to an antiseptic pressure of 3·5 to 12·5 kg/cm^2, depending on the species, size, refractory-nature of the material, etc. This injects the preservative into the timber or the material to be treated. The pressure is held until the desired absorption is obtained, after which the preservative is withdrawn from the cylinder and finally a vacuum or 40 to 55 cm of mercury for about 15 minutes is once again applied to free the material from the dripping preservative. Specified retention of toxic chemicals during treatment may be had by a proper selection of the concentration of the toxic material in the treating solution and suitable absorption of the preservative solution which may be controlled by the duration of pressure and vacuum periods.

5.4.2 *Empty Cell Process* — This process aims at maximum penetration of the preservative in the cell wall with minimum of net absorption. The cell pore is mostly left empty and hence the process is called 'Empty Cell'.

5.4.3 *Lowry Process* — This is an 'Empty Cell' process. In this process, the cylinder is loaded with the material and then the door is closed. It is then filled with the preservative; an antiseptic pressure of 2·0 to 12·5 kg/cm^2, depending on timber species, size, etc, is applied until the required absorption is obtained. The pressure is then released, when a certain volume of the preservative, injected into the material, is expelled due to the expansion of the entrapped air in the cells. The cylinder is then drained off, and finally a vacuum is applied as described in **5.4.1**.

5.5 Glue Line Poisoning — For the treatment of plywood, toxins (water soluble non-fixed type like boric acid 2 percent level or boric acid-borax at 1 : 1 percent level) could be added in the urea glue during the glue mixing stage, thus making the treatment procedure very simple.

6. POST-TREATMENT INSTRUCTIONS

6.1 The material, after treatment should be conditioned to moisture content of not more than 14 percent for interior uses and not more than 18 percent for exterior uses. For certain applications, a higher moisture

content may be agreed to between the supplier and the purchaser. If treated material is required to be painted subsequently, the moisture content shall be not less than 6 percent and not more than 14 percent.

6.2 After treatment of the material (veneers or chips), as given in **5.2** or **5.2.1**, it shall be suitably dried to a moisture content suitable for the gluing conditions which usually does not exceed 10 percent.

7. WORKMANSHIP AND FINISH

7.1 The finished product shall be clean to handle and free from dirt and stain other than any uniform colour of the preservatives.

8. SAMPLING AND TESTING

8.1 For the purpose of test, samples shall be taken out of a batch as given in IS : 303-1975*, IS : 1659-1979† and IS : 2380 (Parts 1 to 21)-1977‡.

8.2 The net absorption of the preservative in the material shall be determined by chemical analysis according to the methods specified in IS : 2753 (Part 1)-1964§ and IS : 2753 (Part 2)-1968‖.

The details of preservatives and their recommended absorption are given in Tables 1 and 2.

8.2.1 The net retention of preservatives may also be evaluated with the figure obtained from service tank reading or weights of the charge before and after treatment.

For this purpose, the manufacturer is required to maintain an absorption log book and furnish a certificate as to the net absorption in kg/m^3. Table 1 gives the composition of different preservatives and their concentration. Table 2 gives the absorption of the preservatives and the process of treatment. These tables also give information on composition to be used on green debarked logs and the concentration of the preservatives to be brushed or sprayed for prophylactic treatments. In the case of treatment, particularly with water soluble preservatives

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*Specification for plywood for general purposes (*second revision*).

†Specification for blockboards (*second revision*).

‡Methods of test for wood particle boards and boards from other lignocellulosic materials (Parts 1 to 21) (*first revision*).

§Methods for estimation of preservatives in treated timber in treating solutions: Part 1 Determination of copper, arsenic, chromium, zinc, boron, creosote and fuel oil.

‖Methods for estimation of preservatives in treated timber in treating solutions: Part 2 Determination of copper (in copper naphthenate and pentachlorophenol).

of both fixed type or otherwise, concentration of the preservative in the solution can be evaluated using suitable hydrometers carefully calibrated for different concentrations.

8.2.2 The extent of penetration of the preservative may be determined by taking out pieces from the treated material at random at least 15 cm away from the edges; also from borings or cross-cut surfaces as specified in one of the methods given in Appendix D of IS : 401-1982*.

*Code of practice for preservation of timber (*third revision*).

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*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
5-8-58C, 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
Patliputra Industrial Estate, PATNA 800013	26 23 05
T. C. No. 14/1421, University P. O. Palayam, THIRUVANANTHAPURAM 695034	6 21 17
NIT Building, Second Floor, Gokulpat Market, NAGPUR 440010	52 51 71
Institution of Engineers (India) Building, 1332 Shivaji Nagar, PUNE 411005	32 36 35

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*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

Printed at New India Printing Press, Khurja, India