Indian Standard (Reaffirmed 1998)

GENERAL REQUIREMENTS FOR SMOOTH-WHEELED DIESEL ROAD ROLLER

(Second Revision)

UDC 625·084—843·6

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

Indian Standard

GENERAL REQUIREMENTS FOR SMOOTH-WHEELED DIESEL ROAD ROLLER

(Second Revision)

0. FOREWORD

0.1 This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards on 29 July 1988, after the draft finalized by the Construction Plant and Machinery Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Smooth-wheeled diesel road rollers are generally employed for compaction of different types of soils under various conditions, initial rolling and finish rolling of bitumen macadam, water-bound macadam, hot and cold asphalt, and to improve the condition of subgrade, sub-base and the base of pavements. Their selection is governed by the types of job and the characteristics of the material to be compacted. In general, they are the best type for use where crushing action is needed. This standard is intended to deal with the essential features of smooth-wheeled diesel road rollers to serve as guidance to both the manufacturer and the purchaser.

0.3 This standard was first published in 1969 and revised in 1980. This revision incorporates modifications with regard to material of different parts and turning radii (inner and outer) for different sizes of rollers have been added.

0.4 The roller shall be so designed that it can operate satisfactorily without damage in the following conditions and also not suffer any damage, if kept idle under the following conditions:

a) Temperature between −10 and 60°C,

b) 100 percent relative humidity at any temperature up to 29°C, and

c) Wind velocity up to 120 km/h.

If specified by purchaser the roller shall be able to work at a temperature between −30 and 60°C. In case no test is carried out for the above conditions, the manufacturer shall give a warranty (for a period of 12 months from the date of commissioning or 18 months from the date of supply, whichever is earlier) for performance of equipment in the above conditions.

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

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

1. SCOPE

1.1 This standard lays down the requirement for material, size, design, construction and performance of smooth-wheeled diesel road rollers.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Line Pressure — The load on the roll divided by the width of the roll expressed as N/mm.

2.2 Nominal Weight — The nominal weight of road roller without ballast corresponds to the dead weight with its basic equipments.

2.3 Operating Weight — The operating weight of road roller without ballast corresponds with the dead weight with its basic equipment including the weight of all tools, with full fuel tank and, if applicable, sprinkling water tank half full, full hydraulic oil tank and an addition of 75 kg for the operator.

2.4 Overlap of Rolls — The portion of track covered by front roll being repeated by one of the rear rolls. In case of three-wheeled roller it is 50 mm minimum.

2.5 Rolling Width — The total width of the road covered by the front and rear roller.

2.6 Tandem Roller — Machine having two rolls of approximately the same width, set one behind the other so that they operate in succession on the same track.

2.7 Turning Radii

2.7.1 *Turning Radius (Outer)* — The radius of the circle described by outer edge of the front roll while the roller is executing its sharpest practicable turn.

2.7.2 *Turning Radius (Inner)* — The radius of the circle described by the inner edge of the rear roll while the roller is executing its sharpest practicable turn.

2.8 Turning Circle — This corresponds to the diameter of the circle which will enclose the outermost projection of the roller with all its basic equipment while executing its sharpest practicable turn.

2.9 Wheel Base — The horizontal distance between the centres of front and rear axles.

3. SIZES

3.1 The sizes of the roller shall be designated by the nominal weight of the equipment (unballasted). This shall be of the following sizes:

1·5 to 3 tonnes, 4 tonnes, 6 tonnes, 8 tonnes and 10 tonnes.

NOTE 1 — The operating weight of the roller shall be within ±5 percent of the nominal weight.

NOTE 2 — In sizes 4, 6, 8 and 10 tonnes, provision shall be made for 20 to 30 percent of ballasting.

4. MATERIALS

4.1 Materials used for the construction of smooth-wheeled diesel road roller shall comply with the requirements given under **4.1.1** to **4.1.12**.

4.1.1 *Steel Sections, Bars and Plates* — shall conform to IS : 226-1975*.

4.1.2 *Mild Steel Sheets* — shall conform to IS : 1079-1973†.

4.1.3 *Steel Castings* — shall be of suitable grades conforming to IS : 2707-1982‡ and IS : 1030-1982§.

4.1.4 *Carbon Steel Forgings* — shall be of suitable class conforming to IS : 2004-1978‖.

4.1.5 *Grey Iron Castings* — shall be of suitable grade conforming to IS : 210-1978¶.

4.1.6 *Rivet Bars* — shall conform to IS : 1148-1982** or IS : 226-1975*.

4.1.7 *Springs* —shall be manufactured from suitable grade of wire conforming to IS : 4454 (Part 1)-1981*.

4.1.8 *Steel Tubes* — shall conform to IS : 1239 (Part 1)-1979† and IS : 1239 (Part 2)-1982‡.

4.1.9 The clutch plate shall be of carbon steel hardened and tempered to a minimum tensile strength of 686 N/mm².

4.1.10 The stalk (K Pin) shall be of carbon or alloy steel with a minimum tensile strength of 617 N/mm². All gears of intershaft, first intershaft, and final drive pinion shall be of alloy steel quenched and tempered to a minimum tensile strength of 686 N/mm². The teeth of the gears shall be case/surface hardened to hardness between 57 to 60 Rc to a depth of 1 to 1·5 mm. The second and third intershaft and differential shaft shall be of carbon or alloy steel having a minimum tensile strength of 617 N/mm². The differential bevel wheels shall be of alloy steel hardened and tempered to a minimum tensile strength of 921 N/mm².

4.1.11 The bevel pinion shall be of alloy steel suitably heat treated, case/surface hardened between 44 to 48 Rc to a depth of 0·8 to 1·1 mm and the tensile strength shall not be less than 686 N/mm².

4.1.12 The front and hind axles shall be of carbon steel conforming to IS : 1570 (Part 2)-1979§ with a minimum tensile strength of 617 N/mm².

5. CONSTRUCTION

5.1 The construction of the smooth-wheeled diesel road roller shall, in general, be robust and capable of withstanding continuous strain likely to be imposed during the operation over rough, rocky or soft grounds.

5.1.1 All parts of the roller requiring frequent replacement or constant attention or periodic servicing shall be easily accessible without dismantling any fittings or parts.

5.2 Main Frame — The main frame shall be made of structural steel with rolled steel channels (or other suitable sections) cross-braced and stayed or all welded plate chassis made of suitable thickness of mild steel plate to form a rigid unit to ensure perfect alignment of the engine and transmission throughout the life of the road roller.

*Specification for structural steel (standard quality) (*fifth revision*).

†Specification for hot rolled carbon steel sheet and strip (*third revision*).

‡Specification for carbon steel castings for surface hardening (*second revision*).

§Specification for carbon steel castings for general engineering purposes (*third revision*).

‖Specification for carbon steel forgings for general engineering purposes (*second revision*).

¶Specification for grey iron castings (*third revision*).

**Specification for hot rolled steel rivet bars (up to 40 mm diameter) for structural purposes (*third revision*).

*Specification for steel wires for cold formed springs: Part 1 Patented and cold drawn steel wires — unalloyed (*second revision*).

†Mild steel tubes, tubulars and other wrought steel fittings: Part 1 Mild steel tubes (*fourth revision*).

‡Mild steel tubes, tubulars and other wrought steel fittings: Part 2 Mild steel tubulars and other wrought steel pipe fittings (*third revision*).

§Schedules for wrought steels for general engineering purposes: Part 2 Carbon steels (unalloyed steels) (*first revision*).

All main working parts, that is, engine, steering head, radiator, gear box, differential gears, rear axle, etc, shall be carried on the main frame and shall not be attached to the superstructure. The pressure balancing device shall also be housed within the frame members.

5.3 Pressure Balancing Device — Pressure balancing device shall comprise a heavy trolley borne weight with arrangement of being clamped at desired position, and shall be movable along the length of a main frame so that with the weights in the forward position and appropriate quantity of ballast in the rollers, pressures per unit contact area in front and rear could be equalized for surface finishing.

5.4 Clutch — The clutch shall be of the heavy automotive double acting single-plate, quick-release type controlled by a single hand lever. A forward or backward movement of the lever shall give a corresponding direction of travel to the roller in any gear setting. The lever controlling the clutch shall be locked in the selected position—forward, neutral or reverse—by a spring loaded catch which engages in a notched quadrant. The different positions of the lever shall be obtained by releasing the spring loaded catch. The clutch shall be of steel and its lining shall be brass wire woven. The pressure ring used in such clutches shall be cast iron.

In an alternative design of cone clutch, the clutch drum shall be of cast iron and clutch cone shall be of aluminium casting provided with clutch lining of brass-wire woven type.

5.4.1 If required, hydraulic coupling may be provided. The hydraulic coupling unit shall generally be fitted between engine and clutch to ensure the smooth take-up of the drive, and to reduce shocks to the engine and transmission while scarifying.

5.5 Fore-carriage Assembly — The arrangement of steering from the fore-carriage shall be robust and ensure uniform pressure over the width of the front rolls. The arrangement shall ensure adequate articulation of the steering roll about the trunnion pins so that it may accommodate up to a minimum 13° inclination without disturbing the stability of the machine. The fork shall be of cast steel conforming to IS : 1030-1982* or of fabricated steel conforming to IS : 226-1975† and shall be machined after proper seasoning in case of the former. The steerage quadrant shall be of cast steel conforming to IS : 1030-1982* or carbon steel conforming to IS : 2004-1978‡ having a minimum tensile strength of 539 N/mm^2. The fore-carriage shall be of cast steel conforming to IS : 1030-1982* or fabricated steel conforming to IS : 226-1975†.

The front roller assembly shall be fitted into this unit and after assembling its clearance with fore-carriage shall be at least 12 mm for smooth operation of machine.

5.6 Rolls — Front and rear rolls shall not be less than 22 mm and 32 mm thick respectively and shall be fabricated from heavy section of heavy steel section of mild steel plates conforming to IS : 226-1975* and shall be electrically welded. The hubs shall be fitted with renewable bushes. The rolls shall be so designed that they can be ballasted with sand and water.

6. ENGINE

6.1 The prime mover shall be a diesel engine conforming to Class B of IS : 10000 (Part 7)-1980†. The engine shall have adequate horse power, capable of operating the road roller, as mentioned in **6.1.1**.

6.1.1 The roller shall be capable of giving its full output up to 1 500 m altitude, but space shall be available to mount a higher horse-power engine to cater for operation up to 5 000 m, when so required.

6.2 The diesel engine shall be provided, with hand or electric or hydraulic or spring starting gear. The electric starter, when provided, shall be on a 12 V/24 V electric system. Arrangements may also be available for hand cranking when electric or hydraulic or spring starters are provided.

7. FUEL SYSTEM

7.1 The fuel tank shall be of sufficient capacity to provide a minimum of 8 hours (depending upon size) running on full load. The filling orifice shall incorporate a removable filter and shall be of such size and so placed that filling by jerricans, without the aid of a funnel, presents no difficulty. Alternatively, a hand operated semi-rotary pump shall be provided. A captive filler cap shall be provided for the filling orifice and the method used for venting the tank to atmosphere shall be such that no fuel spillage occurs, when the machine is travelling with the tank completety full. The draw off from the fuel tank to the engine shall leave 5 percent dead volume below it at any operating angle up to 12°. A plug shall be provided for completely draining the tank. A fuel gauge or dip stick calibrated in litres, shall be fitted to the tank. If required, a hand operated semi-rotary pump shall be fitted to the plant in a position suitable for pumping fuel from containers on the ground to the fuel tank. The pump shall be completed with hose

*Specification for carbon steel castings for general engineering purposes (*third revision*).

†Specification for structural steel (standard quality) (*fifth revision*).

‡Specification for carbon steel forgings for general engineering purposes (*second revision*).

*Specification for structural steel (standard quality) (*fifth revision*).

†Methods of tests for internal combustion engines: Part 7 Governing tests for constant speed engines and selection of engines for use with electrical generators.

and suction strainer which shall be of such diameter as to admit entry to the 50 mm opening in 180-litre drum. The suction hose and strainer shall be secured in such a position as to keep it dry and free from road dirt. Fuel filters of adequate capacity shall be incorporated in the system.

8. RADIATOR

8.1 A radiator of adequate capacity shall be provided in water cooled engines as recommended by prime mover manufacturers to keep the temperature of the coolant always within the permissible limits. The temperature of the coolant shall not exceed a temperature 12°C below the boiling point. The radiator shall be resiliently mounted to withstand road shocks transmitted through the frame. A drain tap shall be provided in the radiator.

9. POWER TRANSMISSION

9.1 The power from the prime mover shall normally be transmitted to the rear rolls in case of three-wheeled roller. However, provision shall be made for locking the differential when working on soft ground, or on steep gradient when using a scarifier or to overcome wheel spin.

9.2 The road rollers except those in size 1·5 to 6 tonnes shall be provided with minimum of three road speeds in forward and reverse direction, the range of speeds shall be as given in Table 1.

TABLE 1 LIMITS OF ROAD SPEEDS FOR POWER TRANSMISSION

Sl No.	Size of Roller	Gear Speed, Forward and Reverse		
		First Gear	Second Gear	Third Gear
(1)	(2)	(3)	(4)	(5)
	tonne	km/h	km/h	km/h
i)	1·5 to 6	1·5-1·9	2·50-3	—
ii)	8 and 10	1·70-2·25	2·75-3·50	6 to 10

9.3 Switchover from forward traverse to reverse traverse shall be with the help of a clutch which can be operated while the roller is moving. Provision shall be made for locking the clutch in both positions to prevent inadvertent operation.

10. GEAR BOX

10.1 Gear box shall be of cast iron or FG 200 of IS : 210-1978* or fabricated from welded mild steel plates. All gears of intershafts shall be of alloy steel.

*Specification for grey iron castings (*third revision*).

10.1.1 A hydrostatic transmission may be used with or without gear box. In such a case suitable arrangement should be provided to tow the machine in case of emergency.

10.2 Differential Shafts — When the final drive is through the differential shafts, its pinions, and bevel wheels and bevel pinion shall be of steel as specified in **4.1.11**.

11. BALLASTING

11.1 Ballasting shall be done by the addition of sand or water or any other suitable material to the rolls which shall be made hollow. Filler holes provided in each roll shall be so placed as to facilitate easy filling and complete draining of the rolls.

11.2 The weight distribution on the front and rear rolls of the roller unballasted shall be within the following limits:

a) 30 to 40 percent of the weight of the machine on the front rolls, and

b) 60 to 70 percent of the weight of the machine on the rear roll(s).

12. BRAKES

12.1 Fully self-wrapping, internal/external, expanding/contracting, shoe/band type brakes acting on the machined inner/outer surfaces of the brake drum shall be provided using suitable brake lining and controlled by a foot pedal or by a hand wheel or lever independently. The hand brake, which is operated by screw type hand wheel or lever, shall be placed to the driver's left hand or right hand side as the case may be. This brake may be used for parking as well as to assist the foot brake while the roller is going down a steep gradient. Adjustment for wear on the brake lining shall be provided. The foot brake shall be capable of stopping the roller instantaneously.

13. STEERING

13.1 Turning radii in case of three-wheeld rollers (*see* Fig. 1) shall not be more than the values specified in Table 2.

13.2 Power Steering — If desired by the purchaser, power steering system may be provided with the rollers of size 8 and 10 tonnes. The system may be of hydraulic power steering or mechanical power steering. In both the systems, there shall be arrangement of disconnecting power units and reinstating hand steering quite simply.

14. GRADIENT

14.1 Rollers of all sizes shall be capable of operating on a gradient of 1 in 5 in both ballasted and unballasted conditions at the first gear speed on firm, hard and even sub-soil in forward or reverse drive.

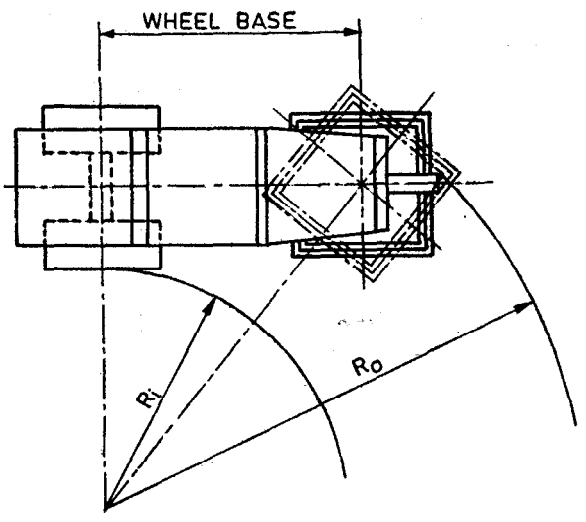

FIG. 1 TURNING RADII OF THREE—WHEELED ROAD ROLLER

TABLE 2 TURNING RADII FOR THREE-WHEELED ROLLER

(*Clause* 13.1)

SL NO.	SIZE OF ROLLER	TURNING RADIUS—INNER (*Ri*)	TURNING RADIUS—OUTER (*Ro*)
	tonnes	mm	mm
(1)	(2)	(3)	(4)
i)	1·5 to 3	2 200	3 400
ii)	4 and 6	2 900	4 400
iii)	8 and 10	3 450	5 800

15. WATER SPRINKLING

15.1 Water sprinkling system shall be provided for front and rear rolls with separate control.

15.2 The minimum capacity of the water tank shall be as given in Table 3.

TABLE 3 MINIMUM CAPACITY OF WATER TANK

SL NO.	SIZE OF ROLLER	MINIMUM CAPACITY OF WATER TANK
	Tonnes	Litres
(1)	(2)	(3)
i)	Up to 1·5	50
ii)	Above 1·5 and up to 6	100
iii)	Above 6	200

16. DRIVER'S SEAT

16.1 An adjustable and comfortable seat shall be provided for the driver.

16.2 The engine fitted in the front side and any other fitting to the sides of the machine shall be such that the operator shall have clear vision at all sides of the machine from his sitting position.

17. AWNING AND CAB

17.1 Suitable, robust sheet steel awning with heat insulating lining shall be provided to protect the operator from the sun and the rain. End and side curtains shall be provided.

17.1.1 Other types of awnings may also be fitted provided equivalent performance is ensured.

17.2 Cab — If required, a cab may be provided in place of awning. The cab shall be of fabricated steel construction and fitted with large safety glass windows in all four sides. The cab shall completely enclose the operator's station. Windscreen wipers shall also be fitted. Provision for exhaust outlet pipe shall be in the rear corner of the cab. If desired by the purchaser, suitable heating arrangement may be provided.

18. ACCESSORIES

18.1 Scarifier — If required by the purchaser, two or more types shall be provided for rollers of sizes 8 and 10 tonnes. These shall be fitted behind one of the rear rolls.

18.2 Scraper — Spring loaded or fixed bar type scrapers to act in either direction shall be fitted for rear roll and front roll. The scraper shall cover the full width of the roll. Elongation holes in the blades shall permit adjustments of gap between the blade and roll surface. Blades shall be reversible to ensure maximum life. Spring pressure shall be adjusted by means of a spring retaining nut for spring loaded scrapers.

19. CONTROLS

19.1 Following controls shall be provided and shall be easily accessible to the operator:

a) Starting and stopping arrangement for prime mover;
b) Gear shifting lever;
c) Parking brake lever;
d) Forward or reverse clutch;
e) Pedal brake;
f) Water sprinkler valves;
g) Accelerating lever;
h) Hand steering wheel;
j) Differential lock;
k) Heater button (cold starting device), if required; and
m) Control for wiper, if fitted.

19.2 Instruments — The following instruments shall be provided:

a) Ammeter;
b) Oil pressure gauge; and
c) Oil temperature gauge, if required.

19.3 Optional Instruments — The following instruments may be provided:

a) Water temperature gauge,
b) Fuel gauge, and
c) Hour meter.

20. LIFTING AND TOWING ARRANGEMENT

20.1 Each roller shall be fitted with a suitable means at only the rear end of the roller for towing purposes.

21. LUBRICATION

21.1 Adequate lubrication of all moving parts shall be provided keeping the maintenance schedule as simple as possible.

22. SAFETY REQUIREMENTS

22.1 Safety guards for moving parts shall be provided. The parts, which are exposed to atmosphere and are liable to become defective due to dust, shall be covered adequately.

22.2 Reflectors at front and rear, at near and off side of the roller, shall be provided to show the presence of the roller at night to the other vehicles using the road.

22.3 Two travelling electric lights at front and one at the rear end of the roller shall be provided.

23. TOOLS AND INSTRUCTION MANUALS

23.1 A strong tool box with a lock and a key, containing the necessary tools for normal running adjustments and lubrication of machine together with instruction manual, operator manual along with the maintenance schedule and an inventory of the tools shall be provided along with the roller. A spare parts book shall be supplied.

24. FINISHING

24.1 All exposed parts of roller shall be painted with suitable anti-corrosive protective paint.

25. MARKING

25 1 Rating Plate — Each roller shall have a rating plate firmly attached to some part which will not be easily removable. The plate shall have clearly marked on it the following information:

a) Manufacturer's name and address;
b) Year of manufacture;
c) Machine reference number;
d) Engine make and serial number, bhp and rev/min;
e) Roller size;
f) Diameter of the rolls; and
g) Line pressure under the rolls with and without ballast.

26. INFORMATION

26.1 The following particulars shall be given with each roller:

a) Unballasted weight;
b) Water, sand, etc, ballasted weight;
c) Forward and reverse speed;
d) Specification of engine;
e) Line pressure on front and rear rolls;
f) Rolling width;
g) Diameter of rear roll;
h) Width of rear roll;
j) Diameter of front roll;
k) Width of front roll;
m) Wheel base;
n) Overlap of rolls;
p) Length;
q) Height with awning or cab;
r) Turning radius — Inner and turning radius — Outer;
s) Turning space;
t) Fuel tank capacity;
u) Sprinkler tank capacity;
w) Hydraulic oil tank capacity, if used; and
y) Capability for negotiating gradient specifying the surfaces.

BUREAU OF INDIAN STANDARDS

Headquarters:

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

Telephones : 3 31 01 31 3 31 13 75 — Telegrams : Manaksanstha (Common to all Offices)

Regional Offices:	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002	3 31 01 31, 3 31 13 75
*Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola, CALCUTTA 700054	36 24 99
Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036	2 18 43, 3 16 41
Southern : C. I. T. Campus, MADRAS 600113	41 24 42, 41 25 19, 41 29 16
†Western : Manakalaya, E9 MIDC, Marol, Andheri (East), BOMBAY 400093	6 32 92 95

Branch Offices:	
'Pushpak', Nurmohamed Shaikh Marg, Khanpur, AHMADABAD 380001	2 63 48, 2 63 49
Peenya Industrial Area, 1st Stage, Bangalore-Tumkur Road, BANGALORE 560058	38 49 55, 38 49 56
Gangotri Complex, 5th Floor, Bhadbhada Road, T. T. Nagar, BHOPAL 462003	6 67 16
Plot No. 82/83 Lewis Road, BHUBANESHWAR 751002	5 36 27
53/5 Ward No. 29, R. G. Barua Road, 5th By-lane, GUWAHATI 781003	—
5-8-56C L. N. Gupta Marg (Nampally Station Road), HYDERABAD 500001	23 10 83
R14 Yudhister Marg, C Scheme, JAIPUR 302005	6 34 71, 6 98 32
117/418 B Sarvodaya Nagar, KANPUR 208005	21 68 76, 21 82 92
Patliputra Industrial Estate, PATNA 800013	6 23 05
T.C. No. 14/1421, University P.O. Palayam, TRIVANDRUM 695035	6 21 04, 6 21 17

Inspection Offices (With Sale Point):	
Pushpanjali, First Floor, 205-A West High Court Road, Shankar Nagar Square, NAGPUR 440010	2 51 71
Institution of Engineers (India) Building, 1332 Shivaji Nagar, PUNE 411005	5 24 35

*Sales Office in Calcutta is at 5 Chowringhee Approach, P.O. Princep Street, CALCUTTA 700072 — 27 68 00

†Sales Office in Bombay is at Novelty Chambers, Grant Road, BOMBAY 400007 — 89 65 28

Printed at Printograph, New Delhi, India