IS 2683 (1980): Guide for installation of impregnation plants for timber [CED 9: Timber and Timber Stores]

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IS : 2683 - 1980
(Reaffirmed 2005)

Indian Standard

GUIDE FOR INSTALLATION OF IMPREGNATION PLANTS FOR TIMBER

(Second Revision)

UDC 676·048·2·005 (026)

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

November 1980

Price Rs 7·00

Indian Standard

GUIDE FOR INSTALLATION OF IMPREGNATION PLANTS FOR TIMBER

(Second Revision)

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Indian Standard

GUIDE FOR INSTALLATION OF IMPREGNATION PLANTS FOR TIMBER

(Second Revision)

0. FOREWORD

0.1 This Indian Standard (Second Revision) was adopted by the Indian Standards Institution on 28 July 1980, after the draft finalized by the Timber Sectional Committee, had been approved by the Civil Engineering Division Council.

0.2 This standard was first published in 1964 and revised in 1966. The use of this standard during the period has indicated the need for further revision. In this revision provisions relating to material and design of cylinder and tanks have been deleted and a cross-reference has been given to the relevant Indian Standard, namely, IS : 2825-1969*.

0.3 Wood preservation plants may be broadly divided into two categories, namely, the pressure plants and the open tank plants. The pressure plants may be further divided into two subsidiary divisions, namely, those in which oil preservatives requiring elevated temperatures during working are used and those in which water soluble preservatives at room temperature are used. Slight modifications in the equipment in these plants are also necessary depending upon which of the three pressure processes, namely, the Full Cell, the Lowry and the Rueping processes (*see* IS : 401-1967†) is employed. Generally, every plant should be provided with necessary auxiliary equipment so as to enable any one of the above processes being employed at one time. Should the conditioning of the timber, that is, seasoning of green timber as in the case of steaming or Boulton process (*see* IS : 401-1967†) or both, is also to be undertaken in these plants, additional equipment may be provided to the main plant.

0.3.1 In open tank plants, generally, oil type of preservatives at elevated temperatures are used. There is only one design, unless these are required to be used in cold, for either water soluble preservatives or organic solvent types of preservatives. In these cases, it is desirable to have a lid on the tank which can be tightly fastened so as to allow light pressure or vacuum being applied.

*Code for unfired pressure vessels.

†Code of practice for preservation of timber (*second revision*).

0.3.2 This standard gives guidance in regard to the essential requirements of the major types of plants indicated above. Mobile plants have not been covered in this standard.

0.4 Various types of preservatives, preparation of timber for treatment, types of treatment processes, the choice of treatment with regard to preservatives and the treatment processes are covered in IS : 401-1967*.

0.5 In the formulation of this standard due weightage has been given to the international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

0.6 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.

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1. SCOPE

1.1 This standard specifies the essential requirements for installation of the following timber treatment plants and their accessories:

a) Pressure treatment plants with:
   1) oil type of preservatives, and
   2) water soluble types of preservatives, and

b) Open tank plant for the treatment of timber by the hot and cold process.

2. PRESSURE TREATMENT PLANTS

2.1 Plants for Oil Type Preservative

2.1.1 *Pressure Treating Cylinder*

a) *Material and design* — The cylinder shall be designed to withstand a working pressure of 1·4 MPa with a factor of safety of 1·9. Regarding the material and design of the cylinder reference may be made to IS : 2825-1969‡.

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*Code of practice for preservation of timber (*second revision*).
†Rules for rounding off numerical values (*revised*).
‡Code for unfired pressure vessels.

b) *Size* — It shall be of specified length depending upon the maximum length of timber to be treated or a multiple of that; the diameter shall be determined by the volume of timber to be treated per charge (*see* Note).

NOTE — The cylinders generally vary in length from 3 to 25 m and in diameter from 0·6 to 2·4 m. The effective volume (the volume of timber which can be satisfactorily loaded in one operation) of the cylinder is about half of its total volume.

c) *Accessories* — It shall be fitted with the following accessories:

1) Charging and discharging cock at the bottom so that it could be filled or emptied in not more than 10 minutes;
2) A transparent level gauge over the top of the cylinder with a protector for observing whether the cylinder has been filled with the preservative liquid;
3) A safety valve which can be adjusted to a pressure of 1·4 MPa;
4) One stop-cock and piping connections to the hydraulic pump;
5) One air compressor-cum-vacuum pump;
6) Thermometer reading up to 150°C;
7) Vacuum-pressure gauge reading up to 76 cm of mercury column and up to 2·0 MPa;
8) Goose neck consisting of a wide and long pipe on the top of the cylinder for preventing overflow of the heating medium (in liquid phase) when boiling under vacuum for removing moisture (conditioning) in the green timber by the Boulton process. It is so called, as the pipe takes the shape of the neck of a goose after the specified height for connecting to the condenser in the vacuum system. It shall be 12 m high and of 50 to 70 mm bore; and
9) It is preferable to have in addition, temperature and pressure recording instruments fitted to the cylinder. Test pressure for steam valves should be 3·5 MPa and for valves not carrying steam should be 2·8 MPa. All pipes shall be capable of withstanding the above working pressures and temperatures.

2.1.1.1 *Foundation* — The cylinder should be suitably mounted on the outer bottom side with rolled steel joists at suitable distance or to any other suitable foundation for the purpose of supporting the entire weight of the cylinder together with timber charge while resting on them.

2.1.1.2 *Door* — The cylinder shall have one or preferably two doors. If the length of the cylinder is 12 m and above, it is preferable to have one door at each end. The groove shall be packed with asbestos rope and graphite paint or any other equally suitable material for securing air-tightness. The whole arrangement shall be such as to maintain a liquid pressure of 1·4 MPa or a vacuum of 60 cm of mercury for a prolonged period of 8 hours or more. There shall be a dip tray at each of the opening.

2.1.1.3 *Rail-track* — In case of cylinders with large diameter, suitable narrow gauge or metre gauge track running along its entire length inside for taking bogies loaded with timber shall be provided along with guard-rail arrangement for holding the bogies to avoid derailment.

2.1.1.4 *Heating units* — The cylinder shall be equipped with suitable runs of steam pipes at the bottom for heating, which shall be protected by a perforated steel plate. A live steam connection along the entire length with holes 45 cm apart shall also be provided for conditioning or seasoning purposes and also for the cleaning of the interior of the cylinder. The entire system shall be below the trolley line. Steam traps shall be provided at the ends of steam pipe lines. The cylinder and the steam pipes shall be suitably lagged against heat losses where necessary.

2.1.2 *Rueping Cylinder*

a) *Material and design* — It shall be designed to withstand a working pressure of 550 kPa with a factor of safety of 1·5. Regarding material and design of cylinder reference may be made to IS : 2825 - 1969*.

b) *Capacity* — It shall be of at least three-fourths the capacity of treating cylinder [*see* **2.1.1**(b)].

c) *Connections* — It shall be fitted with connections and valves to the treating cylinder, air compressor, air-vent and discharge cocks.

NOTE — As an alternative arrangement, where economical, in place of a Rueping cylinder, a high pressure centrifugal pump with a capacity of about 700 kPa may be provided to force preservative in against initial air pressure.

2.1.2.1 *Support* — The cylinder shall be provided with suitable structural support so that its bottom is at least 1·5 m higher than the top of the treating cylinder.

2.1.2.2 *Heating units* — The cylinder shall have heating coil connected to the steam line with a control valve outside. This cylinder and exposed steam pipes shall be suitably lagged against heat losses, where necessary.

2.1.3 *Service Tank*

a) *Material and design* — The material and design shall conform to IS : 2825-1969* or IS : 803-1976†.

b) *Capacity* — It shall be of the same capacity as the treating cylinder [*see* **2.1.1**(b)].

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*Code for unfired pressure vessels.

†Code of practice for design, fabrication and erection of vertical mild steel cylindrical welded oil storage tanks (*first revision*).

c) *Accessories* — It shall be fitted with the following accessories:

1) A gauge with an accuracy of 10 litres for evaluating absorption of the preservatives or a separate gauging tank with at least the same accuracy of measurement,
2) Manhole with cover,
3) Ladder,
4) Drain valve,
5) Steam coils with control valves and a steam trap,
6) Thermometer reading up to 120°C, and
7) Device (antifloat arrangement) for holding the bogies to avoid derailment.

2.1.4 *Storage Tank*

a) *Number* — At least two storage tanks shall be provided one each for creosote and fuel oil,

b) *Material* — The material and design shall conform to IS : 2825-1969* or IS : 803-1976†, and

c) *Capacity* — The capacity of the storage tanks shall be as decided between the supplier and the purchaser. It is recommended that tanks with capacity to hold 4 to 6 months stock of preservatives be provided.

d) *Accessories* — The tanks shall be fitted with the following accessories:

1) Level gauge,
2) Manhole with cover, and
3) Ladders both inside and outside, where necessary.

e) *Connections* — The storage tank shall have connections at the bottom to the mixing or service tank and also for its filling.

2.1.5 *Condenser* — A water-cooled condenser of adequate capacity shall be provided. The condenser shall be made of mild steel plates. The material and design shall conform to IS : 2825-1969* or IS : 803-1976†. A suitable vessel (catch pot) shall be provided, in which condensate is discharged. A conical receiver should be attached to this vessel for the separation of water and preservative oils. The condenser, together with the vessel for receiving the condensate, should be fitted in between the vacuum pump line and the goose neck. For effective protection of vacuum pump for condensation of vapours, an interceptor shall be provided.

*Code for unfired pressure vessels.

†Code of practice for design, fabrication and erection of vertical mild steel cylindrical welded oil storage tanks (*first revision*).

2.1.6 *Pumps*

2.1.6.1 *Centrifugal pumps* — A pump or a number of pumps of suitable capacity, fitted with necessary pipe connections shall be provided for transferring preservatives between the service tank, treating cylinder, storage tank and measuring tank. The pump serving the treating cylinder shall be capable of filling or emptying it in about 10 minutes.

2.1.6.2 *Air compressor-cum-vacuum pump* — One air compressor-cum-vacuum pump fiitted with electric motor of required power shall be provided. When used as a compressor, it shall be capable of creating air pressure of 500 kPa in about 10 minutes in the treating cylinder when fully loaded with timber, and when used as a vacuum pump, it shall be capable of creating a vacuum of about 60 cm of mercury in 10 to 15 minutes in the cylinder.

2.1.6.3 *Hydraulic pressure pump* — A hydraulic pump with suitable motor to create a liquid pressure of 1·4 MPa within 15 minutes in the cylinder when fully loaded with timber and fully filled with preservative and capable of maintaining that pressure continuously for 4 to 5 hours shall be provided.

2.1.7 *Bogies* — At least two sets of bogies shall be provided, one set for loading timber for the subsequent charge while the other set is loaded in the cylinder for taking treatment, on metre gauge or narrow gauge track as the case may be. Each set of bogies should be sufficient to fill the entire cylinder with the timber charge. One or two extra bogies should also be provided as stand by. Each bogie shall have four wheels and fitted with steel stanchions to hold the timber, and shall have suitable bearings preferably of non-ferrous metals for heavy duty work. The use of low friction (ball or roller) bearings with a water-proof grease for water-borne preservative plants and special grease for creosote plants is recommended. The length of each bogie shall be determined with reference to the materials generally treated. Bogies shall have arrangements for coupling.

2.1.8 *Winch* — To load or unload timber charge in the cylinder, a winch or any other similar arrangement shall be provided with necessary accessories of suitable capacity depending upon loads to be handled. It can be electrically or manually operated.

2.1.9 *Track Scale* — A platform weighing machine of suitable capacity and weighing correct up to 1 kg shall be provided. The platform shall be fitted with rails of the same gauge as the trolley track and shall be sufficiently long either to take one or two coupled trolleys at a time. It is preferable to have two such machines, one on each end of the treating cylinder.

2.1.10 *Water Storage Tank* — A water storage tank of suitable capacity (one week's requirement) shall be provided and installed at least 6 m above the ground level. Suitable pipe connections shall be taken from the tank to various points in the plant and yard as may be required.

2.1.11 *Motors* — Electric motors provided shall be suitable for operation from the local supply and shall be supplied with starters complying with local electricity supply regulations. Where electric power is not available, machinery shall be capable of being run by steam or other sources of power.

2.1.12 *Boiler* — A suitable type of boiler shall be provided, if required.

2.2 Plants for Water Soluble Type Preservatives

2.2.1 *Pressure Cylinder* — The cylinder shall comply with the requirements specified in **2.1.1**. However, steam heating coils and temperature measuring instruments need not be provided.

2.2.2 *Rueping Cylinder* — The Rueping cylinder shall comply with the requirements specified in **2.1.2** except that steam heating coils need not be provided. This shall be required only when Rueping process is followed.

2.2.3 *Service Tank* — The service tank shall comply with the requirements specified in **2.1.3** except that steam heating coils need not be provided. For water borne preservative, the same service tank is used as storage tank.

2.2.4 *Mixing Tank*

a) *Material and design* — It shall be made of mild steel plates. The material and design shall conform to IS : 2825-1969* or IS : 803-1976†.

b) *Capacity and shape* — It shall be of at least one fourth the capacity of service tank. It is preferable to have this tank cylindrical in shape.

2.2.4.1 *Stirrer* — The tank shall be provided with electrical stirrer driven by suitable motor. The stirrer and accessories shall be capable of withstanding corrosion. Any other suitable arrangement may also be used for efficient mixing.

2.2.5 *Pumps, Bogies, Winch, Track Scale, Water Storage Tank and Motors* — These shall comply with the requirements specified in **2.1.6** to **2.1.11** respectively.

*Code for unfired pressure vessels.

†Code of practice for design, fabrication and erection of vertical mild steel cylindrical welded oil storage tanks (*first revision*).

2.2.6 *Condenser and Boiler* — If green timber is to be conditioned or sterilized, a condenser and a boiler shall be provided complying with the requirements specified in **2.1.5** and **2.1.12** respectively.

2.3 Line Diagram — A typical line diagram for oil-cum-water borne preservative treatment plant is shown in Fig. 1.

3. OPEN TANK PLANT

3.1 Open Tank — Single

a) *Material and Design* — It shall be fabricated with pressed steel or mild steel plates and shall be designed as per IS : 803-1976* or IS : 804-1967†. The tank shall be designed to withstand the stresses induced by the timber charge and preservatives when it is fully loaded. Vertical angle irons shall be welded internally on both the long sides and cross bars may be fixed across the same width anywhere from bottom to top for preventing timber from floating above the level of preservatives.

b) *Size and Shape* — It shall be rectangular in shape; the length depending on the maximum length of timber to be treated. The volume of the tank should be generally twice the volume of timber to be treated per charge.

c) *Accessories* — Necessary accessories like steam trap, piping connections for inlet of preservatives and drainage of the same, valves, cocks, etc shall be provided.

d) *Top Cover* — The tank shall have a top cover made of 0·8 mm thick galvanized iron sheet to prevent rain water entering into it and shall be made of 3 or 4 sections so that they can be easily removed and replaced, when necessary.

e) *Heating Units* — The tank shall be provided internally along the length with sufficient number of heating coils made of at least 25 mm bore steam pipe so as to raise the temperature of the preservative together with the timber charge to 95°C in about one hour's time. The coils shall rest about 5 cm from the bottom of the tank and shall be suitably protected so that timber charge may not rest directly on them.

3.2 Open Tank — Twin-Tanks — Instead of a single open tank, two indentical tanks of same size and shape and placed side-by-side may be used. They shall be connected to each other with one wide pipe provided with a stop cock at two thirds of the height of the tank measured from bottom. This is for transfer of hot preservative from one

*Code of practice for design, fabrication and erection of vertical mild steel cylindrical welded oil storage tanks (*first revision*).

†Rectangular pressed steel tanks (*first revision*).

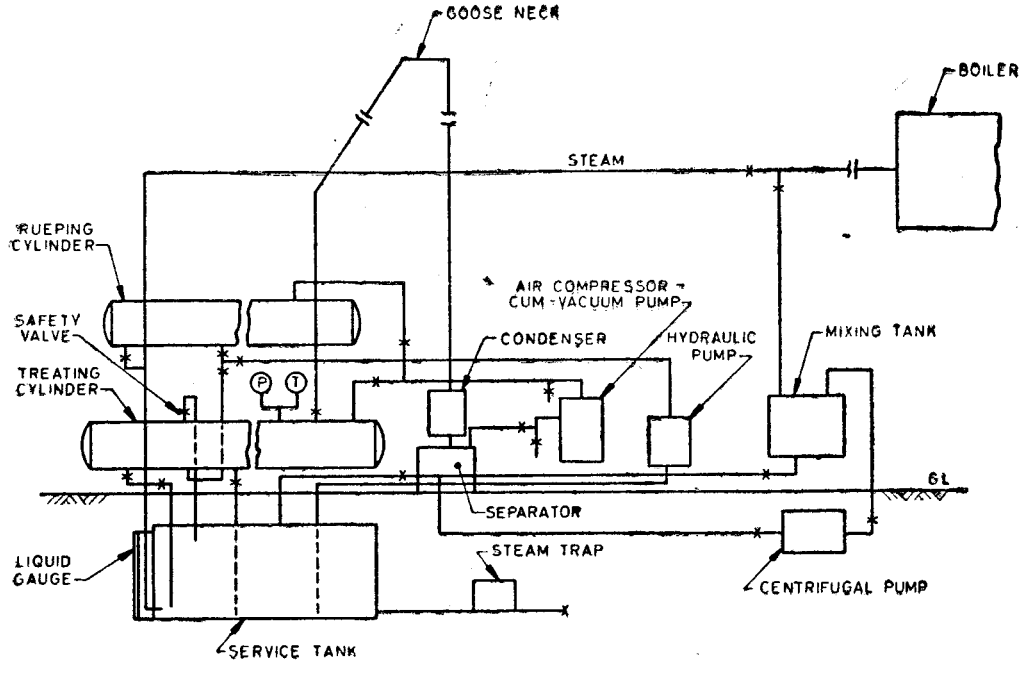
tank to another. The other items, such as accessories, top cover and heating units, are provided identically in both the tanks, as in the single tank. Both the treatment tanks are also provided with extra wide drainage pipe with stop cock at two thirds of the height of the tank for quick drainage to pit, or drainage tank located below ground level (*see* Fig. 2).

3.2.1 *Procedure of Treatment with a Twin-Tank* — Weighed wood shall be loaded in one of the open tanks and filled with oil-type preservative from storage tank till all the material is completely submerged (*see* Fig. 2). It shall be heated gradually up to required temperature by passing steam through steam coils and maintained at that temperature for a definite period depending upon species, moisture content and size of timber and absorption required. After heating period, instead of waiting for natural cooling, the stop cock connecting the twin-tanks shall be opened to transfer the already hot preservative from the first to the second tank and at the same time, cold preservative from storage tank shall be allowed to discharge into the first treatment tank at the same rate as the displacement of the hot preservative takes place into the second treatment tank where a fresh charge of weighed timber is already loaded. When the displacement is complete (that is, when the second treatment tank is filled with hot preservative), the connecting stop cock of twin-tanks shall be closed. To cool further the preservative in the first tank, the preservative in this tank shall be slowly discharged into the drainage tank while cold preservative from storage tank shall be continually admitted into this tank at an equal rate. After desired time of cooling of timber in the cold preservative in the first tank, the entire preservative shall then be drained into the drainage tank by opening the bottom stop cock of the tank. After dripping of preservative, the charge shall be removed and weighed to calculate the absorption.

Now the second treatment tank containing hot preservative from the first tank shall be further raised (in short time) to the required temperature by passing steam through its coils and maintained at that temperature for the required time.

The first empty treatment tank shall then be loaded with fresh weighed wood. It shall be filled with hot preservative from the second tank by the same displacement procedure as mentioned above, and the process shall be continued alternately between the two tanks. This continuous process of treatment, utilizing the hot preservative from one treatment tank into the other, results in savings in costs of heating and time required in cooling; thereby overall output is increased and cost of treatment is reduced.

3.3 Service Tank — This tank shall be of the same size as the open tank and shall be provided with steam coils and lid as specified in **3.1**. It shall comply with requirements given in **2.1.3**(a).

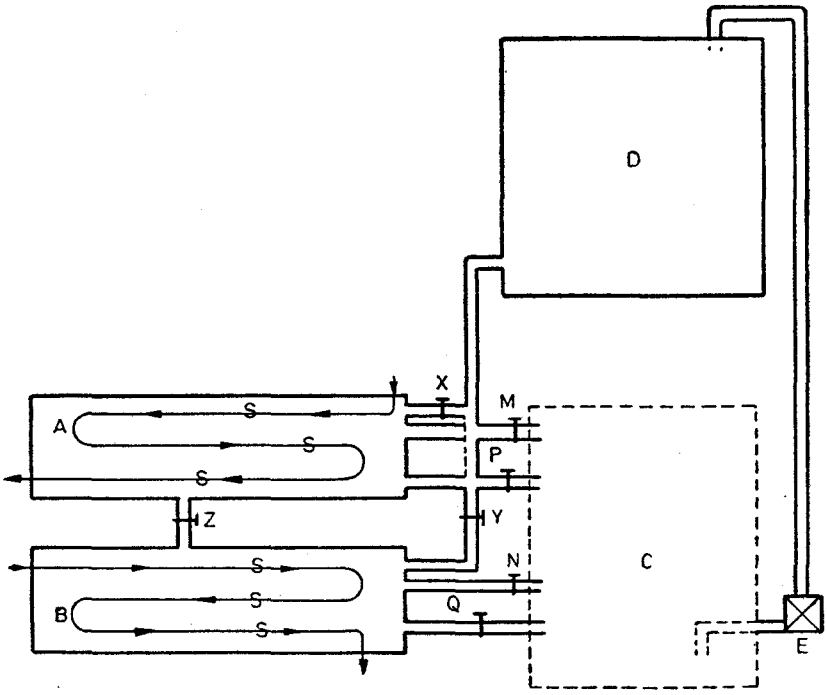


P = pressure recorder,

T = temperature recorder,

NOTE — Storage tanks may be of required numbers depending on reserve stock of preservative solutions and are connecting with steam pipes, when necessary.

FIG. 1 LINE DIAGRAM FOR OIL CUM WATER-BORNE PRESERVATIVE TREATMENT PLANT



A & B = Treatment tanks with steam coils 's' at the bottom
C = Pit or drainage tank below ground level
D = Storage tank
E = Centrifugal pump
X & Y = Stop-cocks connecting A & B with D at the bottom
Z = Stop-cock connecting A & B at 2/3rd height
M & N = Stop-cocks for drainage from A & D to C at 2/3rd height
P & Q = Stop-cocks for drainage from A & B to C at the bottom

FIG. 2 LINE SKETCH OF TWIN-TANKS, OPEN TANK PLANT

3.4 Charge Pump — This shall be centrifugal pump coupled to an electric motor capable of filling the open tank with preservative from the service tank or *vice versa*, in about 15 minutes.

3.5 Storage Tanks — These shall comply with the requirements laid down in **2.1.4**.

3.6 Other Accessories

3.6.1 One set consisting of one recording thermometer and one ordinary glass thermometer, both reading from 0° to 100°C, shall be provided.

3.6.2 In case of big capacity tanks, when timbers like poles and sleepers are treated, suitable portable cranes shall also be provided.

3.6.3 A suitable boiler shall be provided.

3.6.4 A suitable water tank at a height of not less than 6 m capable of holding at least one week's requirement, shall be provided with necessary pipe connections.

(*Continued from page* 2)

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	1 N = 1 $kg.m/s^2$
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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Telephones : 26 60 21, 27 01 31 **Telegrams : Manaksanstha**

Regional Offices :

		Telephone
Western : Novelty Chambers, Grant Road	BOMBAY 400007	37 97 29
Eastern : 5 Chowringhee Approach	CALCUTTA 700072	27 50 90
Southern : C. I. T. Campus, Adyar	MADRAS 600020	41 24 42

Branch Offices:

'Pushpak' Nurmohamed Shaikh Marg, Khanpur	AHMADABAD 380001	2 03 91
'F' Block, Unity Bldg, Narasimharaja Square	BANGALORE 560002	2 76 49
Gangotri Complex, Bhadbhada Road, T.T. Nagar	BHOPAL 462003	6 27 16
22E Kalpana Area	BHUBANESHWAR 751014	5 36 27
Ahimsa Bldg, SCO 82-83, Sector 17C	CHANDIGARH 160017	2 83 20
6-8-56C L. N. Gupta Marg	HYDERABAD 500001	22 10 83
D-277 Todarmal Marg, Banipark	JAIPUR 302006	6 98 32
117/418 B Sarvodaya Nagar	KANPUR 208005	8 12 72
Patliputra Industrial Estate	PATNA 800013	6 28 08
Hantex Bldg (2nd Floor), Rly Station Road	TRIVANDRUM 695001	32 27